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ROYAL BOTANIC GARDENS, KEW.

BULLETIN

OF

MISCELLANEOUS INFORMATION.

No. 2] [1922

VIII.—SIR JOHN KIRK.

By the lamented death of Sir John Kirk, G.C.M.G., K.C.B., F.R.S., M.D., LL.D., D.Sc., D.C.L., &c. on January 15th, 1922, in his 90th year, Kew has lost a most valued friend, keenly interested in many branches of botanical science. For some sixty four years Sir John Kirk was in correspondence with Kew and he was a frequent visitor to the Gardens and the Herbarium whenever he was in England. By his presentations of large collections of Herbarium specimens of the Flora of East and Central Africa, Zanzibar and the Somali Coast, by many gifts of living plants of great interest to the Gardens and by valuable collections of economic products to the Museums from East Africa, &c., he enriched the National Collections at Kew to an extent that was almost unprecedented. The large and varied collection of economic products contributed between the years 1858 and 1891 included a valuable and complete series of specimens illustrating the Zanzibar Copal Industry (1868–70); specimens of 'Buaze' (*Securidaca longepedunculata*)—fibre and fish-nets made from same from the Zambesi (1860), Baobab (*Adansonia digitata*)—fibre with net used for catching large game, East Africa (1860); wheat from Tette (1860) and a series of Flax (*Linum usitatissimum*) specimens from Scotland (1858). Some further particulars of some of the East African contributions are given below, together with a list of the plants contributed to the Gardens.

Sir John was the second son of the Rev. John Kirk of Arbirlot, and was born at Barry near Arbroath on December 19th, 1832. His earliest study was Botany, but he chose Medicine as his profession and, entering the University of Edinburgh before he was 15, graduated as M.D. and L.R.C.S. in 1854. This year saw the outbreak of the Crimean War and Kirk with other young Edinburgh graduates joined the Civil Medical Staff and served in

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Turkey and the Dardanelles. When there he found time to keep up his botanical work and made some excursions into the interior of Anatolia. The numerous plants he was able to collect are preserved in the Herbarium of the Royal Botanic Garden, Edinburgh. On his return to England at the end of the War, in 1857, his long and valuable correspondence with Kew commenced.

His earliest letters preserved at Kew are dated Oct. 17th and Nov. 12th 1857 from Arbroath. It is clear that he must have been in correspondence with Sir William Hooker before that date but unfortunately any earlier correspondence there may have been does not exist.

17th Oct. 1857.

Dear Sir,

I have been for some time residing in the centre of the Flax Manufactures. If your Museum is not already supplied with specimens of the various qualities of the manufactured and prepared article I shall have much pleasure in supplying them.

The *Muscari* concerning which we took the liberty of consulting you when in London has turned out to be quite a new species to which Dr. Playne Armitage and I have given the name of *M. latifolium.*

I have been busy with my Syrian collection but it is little I can do in the country without books and Herbarium. Dr. Parkes has inserted a list of the plants collected at Renkiri [Renkioi] in his Hospital Report.

Believe me,
sincerely yours,
(signed) JOHN KIRK.

12th Nov. 1857.

Dear Sir,

I beg to acknowledge receipt of your letter relative to the specimens of Flax. I have now obtained the different qualities and shall soon have the material showing the various stages of manufacture.

Dr. Balfour has advised me to apply for a situation in one of the Canadian Schools as teacher of Natural Science.

Should you consider me fitted for such an office I trust you will not think me too bold in requesting you to grant me a few lines to that effect.

Believe me,
Dear Sir,
Your most obedt. Servant,
(signed) JOHN KIRK, M.D.

P.S.—I send a few Photographs which I took in the East.

I. Valonea oak (*Quercus Aegilops*) Renkiri, Dardanelles, 1856.
II. Group of Valonea. *Q. Aegilops*, Dardanelles.

III. *Pinus Pinaster*, Renkiri.
This is the same as covers the whole of the Ida range and furnishes fine timber.

IV. *Cupressus horizontalis*, Kuzhiri, Dardanelles.

These letters show that he was keenly interested in matters of Economic Botany and also the extent to which he had been able to devote his leisure moments to the study of the Syrian flora during his Service in the Crimean campaign. He was appointed assistant physician at the hospital at Renkioi in the Dardanelles and found time for excursions into the interior of Anatolia. Writing to Sir William Thiselton-Dyer on October 14, 1915, it is of interest to quote the final paragraph of his letter with reference to the Dardanelles campaign. "What a muddle we are making—I was over a year on the Dardanelles some 60 years ago and knew we could do nothing there but lose men."

It was on his return from the Crimea that the chance came to him to accompany Livingstone on his Zambesi Expedition and led to his becoming one of the most famous and distinguished Colonial servants that the British Empire has known. The story is—and we believe it to be true—that on the day after his return from the Crimea he met Prof. John Hutton Balfour in Queen Street, Edinburgh, who offered him the appointment of Naturalist to Livingstone's second Expedition. Kirk with that eagerness and impetuosity which was so characteristic of him replied 'start to-morrow'! Whether Prof. Balfour's invitation was due to the instance of Sir William Hooker or more probably to Dr. Risden Bennet—a close personal friend both of Prof. Balfour and Dr. Livingstone—is not known, but Kirk was evidently in close touch with Kew at the time and we find in the *Kew Report* for the year 1857 (p. 4) that "Dr. Kirk, about to start with Dr. Livingstone as Naturalist, studied in the Botanical Library and Herbarium for a length of time in preparation for foreign travel." The Expedition left England in March 1858 and for five eventful years Kirk was Chief Officer—the second in command having resigned at the outset—and the "tried and valued associate" of Livingstone. The Expedition went by way of Sierra Leone and the Cape and the following letter from Kirk was written to Sir Joseph Hooker on April 30th, 1858 in Simon's Bay on board the S.S. "Pearl."

My dear Dr. Hooker,

You will be glad to hear of the safe arrival of Dr. Livingstone and party at this port. We have made a good passage but in a small ship such as this we have of course had a good shaking.

At Sierra Leone we remained for six days and I made a small collection of plants and of other specimens, such of these as I have been able to preserve under the disadvantageous circumstances I send off from here. The only Zoological specimens worth anything are the two bottles of jumping fish, I caught them a good way up the river, running about out of the water on the mud.

They go along at a good rate and can make a jump of 1½ feet or more. They retreat, when disturbed, to holes. It was not very easy to capture them as they kept to the wet mud left beyond the Mangroves at low water.

I examined the islands up the creeks to the north of Sierra Leone during an excursion of three days. As all this time was spent among Mangroves and mudbanks and the heat very great, never under 85°, I found considerable difficulty in preserving specimens, and I looked on it as of more importance for me to examine and dissect than to preserve, most of the plants of the district being already in England. I send you two cases. Such vegetable products as I obtained I have tried to connect with the plants yielding them, but I found that extreme caution was requisite before receiving native testimony. May 1st. I shall send you full details from Tete by the "Pearl" on her return. We are off sooner than I expected. I have been engaged in the Cape with Dr. Pappe.

I have sent you the two boxes of specimens by the "Castor." I hope they reach safely.

In great haste. Remember me kindly to your Brother.

Yours very sincerely,

(signed) JOHN KIRK.

While in East Africa with Livingstone, Kirk sent long and very interesting letters to Kew dealing not only with the Botany of Tropical Africa, but with the Geology, Mineral Resources and Geography of the country. They cannot unfortunately be reproduced in extenso here, but the following extracts relating more especially to his Botanical activities show his keen interest as a Naturalist and his activity as an observer. On the Zambesi he enjoyed very good health, and it is remarkable, despite the time that had to be given to medical work on behalf of members of the Expedition, the amount of time he was able to devote to scientific studies.

In those early days transport was difficult and very uncertain, We learn from one of his letters that he once had five cases of specimens packed for a year before they could be despatched. The vessel they used to explore the Zambesi, the "Pioneer," was most unsatisfactory. Writing to J. D. Hooker in December, 1860, from the Zambesi between Tette and Senna, he says:—"The plants I have sent will give a very good idea of the Flora of the Zambesi and the Manganja highlands, but the latter being explored on foot, the collections were limited, as people are not easily got to carry things and on journeys of geographical discovery the preservation of specimens is a hard task. The miserable state of the vessel, overrun with all sorts of vermin, has kept me from consulting my plants once they have been dried. She is in a bad state, with more holes than sound iron in the bottom. We keep the fires in by constant pumping with the aid of a few buckets, but once a day we commonly have to stop to fill up some big hole."

Describing a journey in canoes down a narrow gorge with a swift current, he wrote :—" My canoe, having the best boatmen, passed safely, and we were ready to save Dr. Livingstone whom no one thought could escape, as his canoe got into a strong whirlpool; while we looked at him for a moment, forgetting ourselves, our canoe was dashed with great force against the perpendicular rocks and instantly upset. In such a place it was not easy to save ourselves and the others could give little assistance."

" Fortunately Dr. Livingstone's canoe escaped . . . and by good luck one of my men got hold of a small rock and kept my canoe from going down the stream, in which case we should have had no chance. I was sucked under her by the current, but got up on a small corner of rock where I could just stand. One of the other canoes then came up to us and we got to a place where it was possible to climb up. In this unlucky accident my plants, notes drawings etc. all went with the exception of a few plants which I seized as they were about to sink. On getting out I found myself possessed of the shirt on my back, a rifle and Lindley's 'Vegetable Kingdom,' with a long weary march before us to Tette, all clothes bedding etc. gone. However the plants I have saved are those from the Victoria Falls, so we have something new even out of this wreck. I am in a very unfit state for a journey now, without barometer, thermometer, lenses and surgical instruments, all of which went down the rapids, along with the chronometer, which will keep Greenwich time in some quiet pool fifteen fathoms deep."

Describing the climate of the Zambesi, Kirk writes :—" When we come to the ascent of the Batoka hills it is very different. The river valley there is 1000 feet above the sea-level while the hills are from 3000 to 4000 feet. After making the ascent of 1000 feet above the valley, we find an entirely new Flora, the climate becomes quite changed and one feels quite invigorated. In the valley there is a constant sleepiness which acts very injuriously on Europeans but of which they become insensible after some time, and the change is only perceived on going to some healthy country such as this when the marked difference is at once felt."

" The whole of the southern slope of these highlands is well wooded and reminded me much of the Manganja hills, but being much less humid there was a want of the many rich-coloured herbs which adorn the latter country."

" We had some very cold nights on these slopes and the thermometer was observed on one stream bed at 25° and ice formed near the edge, at a short distance up the hills the temperature was above freezing. On the table lands the air was not so cold at night while even during the day the sun never felt oppressively hot. This was the cold season, but during the heat of September and October, previous to the rains, the air becomes much hotter than at the coast, and during our return in crossing these highlands we had the mercury in the shade at 102° with a difference of 40° between the dry and wet bulbs."

Exploring the Rovuma River for a route to Lake Nyassa he speaks of the dangers from the natives :—" On the lower part no trade exists; the people are robbers who sport men's heads on poles when they can get them. They would have done the same with us but found that we could give them more than they cared for. Some of their arrows went near us, and four musket balls passed through one of the boat's sails, but when two of their number fell to our first shots they made off and never troubled us more, nor had we a chance of giving them a better lesson. We stood a great deal of nonsense from them in the first place, even allowing them to fire at us without returning it, but when it came to 20 yards practice it was rather too dangerous. Confined to our boats among such people, I have made almost no collection."

His descriptions of the vegetation on the banks of the Zambesi are graphic and instructive. Writing to Sir William Hooker in February 1860, he says —" I hope you will receive the entire collection made on the bank of the Zambesi between the sea and Tette, and also that on the river Shire and among the Manganja hills to the north extending as far as S. Lat. 14° 25′. This country offers considerable diversity of climate and position. That of the sea coast is damp, abounding in trees of the Mangrove and *Avicennia* and others inhabiting the soft mud of tropical coasts, at the distance of a few miles up the mouths of the river, these become replaced by a more varied forest of *Pandanus* and *Barringtonia* while there are many open spots covered with a dwarf variety of the *Hyphaene* and the Date Palm, with a large bush, a species of *Strychnos*, whose fruit is acid, the pulp in which the seeds are imbedded being quite wholesome although the seeds themselves are apt to cause pain and vomiting. There is another fruit tree of the order *Clusiaceae* (*Guttiferae*) called 'Motsami' which grows both at the sea coast and inland."

" The coast vegetation extends only about 10 miles up the river; there the mud banks disappear, their place being taken by sand, and instead of the forest we find extensive grass lands. The Delta may be said to reach as far as Mazaro where the river, which flows to the town of Quilimane, is given off, it is not a branch of the Zambesi, as it is only when in high flood that the water of the Zambesi passes through it; during the greater part of the year it is quite dry. The Portuguese say that in former times they could pass by it at all seasons, if so there has been a great change taking place."

" These delta lands are low and feverish, but we have not observed fevers such as are described on the rivers of the West Coast of Africa, and when seized and taken early they have been easily removed. Quinine seems to us to be of no service in preventing, although it is most useful in curing these fevers."

" This large extent of land from Quilimane to the Kongone on the coast and islands as far as Mazaro is well suited for cotton, sugar-cane and rice; wheat is grown, but of inferior quality. Cotton once introduced propagates itself and when not burned

down with the grass becomes a perennial bush. There are two species of it in the country, one named '*Tonje Kaja*' or native cotton, seems to have been the plant first known, but there is no evidence of it but as cultivated or as having escaped from former plantations; the fibre of this adheres strongly to the seed and cannot be removed completely; it resembles wool, being coarse and stiff; the staple is short, and the plant yields much less than the other species the '*Tonje Manga*' [*Gossypium hirsutum*, Linn.] or Foreign Cotton. The name indicates that it is from abroad, probably having come with the Arabs. Some of the varieties of this are of excellent quality and would at once draw a high price in England. I have seen some of it an inch in length; it grows readily and near where we are now, it is to be found growing uncared for and of fine quality nevertheless. It is to be found on the Zambesi as far as we have been (that is 60 miles beyond Tette). It is grown on the Shire and in the lands to the north as far as Lat. 16° S.; beyond this it is replaced by the '*Tonje Kaja*' which is found in the other parts also. We do not meet with it again until we reach Lat. 15° S. when it becomes more frequent as we approach the southern end of the Lake Nyassa, which is the line of trade between the coast to the north of Mozambique and the interior of Londa."

"Sugar-cane was cultivated in the Delta by the Portuguese in former times, and a little is grown by the natives and refugées who now inhabit these parts. No doubt the soil is well suited for it. At present the rich lands of the Delta are almost uninhabited, having been destroyed by war and the slave trade."

"In many parts there is evidence of former settlements, the Mango trees and Cocoa-nuts still remaining. The white Guava [*Psidium Guayava*, Linn. var.] has become wild throughout the forest beyond the Mangroves, and the fruit is gathered yearly and sent to the Portuguese towns."

"From Mazaro to Lupata, where for the first time the Zambesi is narrowed by rocks, the hills come down near to the river in the upper part beyond Senna, while below this the country is like that of the Delta, covered with gigantic grasses which exclude other vegetation. From there the forests which cover the interior come down near to the banks. This intermediate district is very rich and yields a considerable proportion of the food used by the settlements in the neighbourhood."

"The estate of Shupanga possesses the great forests from which the large canoes are obtained, some of these cut out from a single trunk, 36 feet long and 5 feet beam, cost £70 each; the forests are at some distance off and I have not been able to reach them."

"In the same locality the India-rubber plant [*Landolphia Kirkii*] is abundant; it is a climber with rough bark and woody stem. The fruit is eatable. The gum [rubber] is collected by the people and employed in a few domestic articles such as drums and mixed with oil as a cement; with a little care in

gathering it might become an important article of commerce; the plant is abundant and the trouble of collecting very small. The surface of the bark is cut off until the inner is reached, when, after a few punctures have been made, the milky juice runs out and being removed by the finger and applied to the skin of the body dries instantly; by a repetition of this process a thin cake is formed and rolled up in a ball to which the fresh layers are successively applied. At the season when I saw it gathered there was no troublesome drying required."

"Between Senna and Shupanga on the north left hand bank of the river a few hills of quartz and trap come down to the water edge. They are the southern extremity of hilly country extending north and a little west of which Moramballa is the only mountain of considerable size; to the west of these hills and at the western slope of Moramballa the River Shire flows to join the Zambesi,—near Shamwara hill. Among these hills the 'Buaze' plant [*Securidaca longepedunculata*, Fres.] is abundant; it is a bush with erect stem sometimes 4 inches in diameter and 12 feet high but oftener of smaller size. It gives off above a number of slender twigs, which may be cut annually for the sake of the fibrous bark; by this process the plant is not injured. I have sent dissections of the flower of this plant home among the collection of drawings. It seems to be a new genus of the *Polygalaceae*. The seed contains a drying oil which might be used for the same purpose as linseed oil. Among the woods you will find the stem of the 'Buaze'; it is remarkable from including layers of fibrous bark at intervals imbedded between the woody zones. For the growth of the 'Buaze,' little care is required; it germinates easily and grows in rocky grounds which would serve for little else. It is nowhere cultivated, but the people make fishing nets of it such as I sent you by the Lynx gunboat in December."

"Between Lupata and Tette and as far as Kelrabassa, the banks of the Zambesi are high and rocky, the climate is more healthy, but the cultivable lands not so extensive."

"Here the wheat is grown which supplies the province; it is sown in holes during the cold season. It can only be grown in places which have been under the influence of the river when in flood as there is no rain then to supply moisture."

"In damp places sugar-cane is cultivated, and sugar extracted from it by a rude mill, the crushing of the cane is effected in such an imperfect manner that the sugar always possesses a disagreeable flavour which depends entirely on faulty manufacture."

"The cultivation and produce of sugar might be made a highly profitable business in these parts, as also throughout the whole country from the sea upwards. In the rich valleys among the mountains of Kelrabassa, cotton is grown for native use; it is of both sorts, but the '*Tonje Manga*' is the more common; it is grown on perennial bushes, which are pruned yearly and

shoot up even after being burned down. This region from Shupanga to Kelrabassa is well stocked with fine woods."

"In waste ground near the settlements of Shupanga, Senna and Tette, the Indigo plant [*Indigofera tinctoria*, Linn.] grows wild, but the people are quite unacquainted with its value; at Shupanga it is often 5 feet high and I have made indigo from the leaves which seemed to be good, considering the small scale on which it was made."

"The *Borassus* palm [*Borassus flabellifer*, Linn.] with stem 80 feet high bears a long cluster of fruits, the yellow fulvous pulp surrounding the three seeds is agreeable when ripe and much eaten by the elephants. The *Hyphaene* palm has a fruit resembling that of the Doum of Egypt, from which I do not feel quite satisfied that it differs materially; at the coast this palm is a small bush or with only a short stem which is frequently divided dichotomously; in the upper parts it is much higher, being 30 feet, and I have not observed this variety branching. I can find no specific distinction however between these two forms [probably the same—*Hyphaene thebaica*, Mart.]."

On his return from the Zambesi in 1863, Kirk spent some time at Kew working on his collections and in January, 1866, he was appointed Acting Surgeon to the Political Agency at Zanzibar. His administrative abilities led to his being made Vice-Consul in 1867, and in the following year Assistant Political Officer. In April 1873 he became Agent and Consul-General and held that Office until his retirement in 1887.

During his twenty-one years of service in Zanzibar, Kirk was in constant correspondence with Kew and his letters to Sir William, and Sir Joseph Hooker and later to Sir William Thiselton-Dyer contain much information about the vegetation and products of East Tropical Africa. He investigated the source of the different grades of the valuable East African Copal, *Trachylobium Hornemannianum*, Hayne, of which, as already mentioned, he sent excellent specimens of the gum and tree. Great quantities of the Copal were at that time dug by the natives of the mainland, being the remains of ancient forests of this tree.

The following is an extract from one of his letters to J. D. Hooker on this subject dated Zanzibar, 20 March, 1868:—

"While enjoying a little relaxation and breathing the fresh air for a few days on the African mainland. . . . . I met with one or two things worthy of note which will prove of interest to you, being supplemented by specimens. . . . . The spot we selected for our holiday was opposite the southern end of Zanzibar island, where we could remain at anchor in a large spacious creek which there furnished a natural harbour. The immediate sea-edge is lined with Mangrove vegetation composed of *Avicennia*, *Sonneratia*, *Rhizophora*, *Bruguiera*, etc., the last yielding the well known Zanzibar 'Benti' or rafters on which the flat roofs of the houses are supported. A few paces from the

water edge the ground rises suddenly to a height of 30 feet, whence a flat plain extends inland to the foot of the coast ridge, distant perhaps 20 miles. The section of this flat maritime plain consists of sand, gravel, vegetable mould and clay, sometimes with beds of water-worn pebbles, and such is the surface of the soil too, unless where hollows have accumulated dark soil, the produce of many seasons and rotting marsh vegetation."

"This coast fringe of Eastern Africa is obviously a sea beach left by the receding waters as this point of the continent was slowly upheaved. The first coast range is the landward limit of this sand formation, which varies in width from 20 to 100 miles, the latter width being only met with in what are now river valleys, as on the Rovuma, where the sandy gravel extends far inland having on either side older strata."

"The vegetation along the creek of Dar-es-Salam, where we were, consisted of many curious and to me unknown bushes, with heavy timber scattered here and there. Among the latter was the *Trachylobium mossambicense*,* Klotzsch, distinguished by its rounded head of glossy leaves with white groups of flowers projecting from the points of the branches. This is the 'M'Sandarusi' (Tree of Copal) of the natives, and from it one variety of Copal is obtained. On examining the tree more closely, the trunk and main limbs were seen to be covered with the clear resinous exudation, now brittle and hard; from the upper branches it dropped down on the ground below, but not in a fluid state. To judge by the appearance it presented I should say that the resin dries and hardens after being exuded but must be easily broken off by violence. Pieces of various tint and form were collected, some with insects imbedded, but all presented a smooth polished exterior quite free of any pitting or 'goose-skin' known in all kinds dug up from the ground. This sort is known in trade as 'Sandarusi-ya-su'ti,' or 'Copal from the tree.' It is exported in considerable quantity to India but not to Europe."

"Having thus established the source of one sort of Copal to be the *Trachylobium* and transmitted the resin with full herbarium specimens of flower and fruit, which if I mistake not are to this day *desiderata* in all our collections, let me briefly state my reasons for thinking that in this we have the source of the oldest Zanzibar copal, the semi-fossil or bituminized resin known in the English market as 'Animi,' and which is the most valuable of all resins for the manufacture of varnish, exceeding anything produced on the west coast for hardness, elasticity and polish. There are three distinct kinds of Copal in the Zanzibar trade, subdivided by merchants into many classes according to colour, form, surface, and the other peculiarities known to those in the trade and affecting the value variously in different markets. First we have 'Sandarusi-ya-su'ti,' Tree Copal; secondly 'Chakazi,' or copal dug from the soil but modern (seemingly) in

* *Trachylobium Hornemannianum*, Hayne (Leguminoseae).

origin and obtaining a price like that of the former quality; the third is the true 'Sandarusi,' like the second dug up from the soil but hard, less soluble, and more than twice the value. This last forms by far the greatest part of Zanzibar Copal, the export of which has sometimes reached 800,000 lbs., or a value of £60,000." . . . .

"*Trachylobium mossambicense* is found along the coast between 3° and 15° South latitude, but it is not common between Cape Delgado and Mombasa.* It occurs along the creeks and on the maritime plain or old sea beach, but becomes very rare at a little distance inland, and quite unknown long before the change in geological structure offers an explanation for its absence. It requires the near presence of the sea for its growth and dies when far removed from its influence."

Dr. Kirk goes on further to describe in considerable detail the varieties of copal, and states that the most valuable, the 'Animi' of the English markets, is undoubtedly the produce of former forests of *Trachylobium mossambicense*, present in a fossil state all along the ancient sea-beach, some places being richer than others, and certain soils indicating good 'diggings.' Dr. Kirk searched for portions of leaves or flowers of the *Trachylobium* amongst the fossil copal, but never succeeded in obtaining any specimens.

The *Kew Reports* from 1857 to 1882 contain in almost every year references to specimens and plants sent to Kew by Sir John Kirk, at first from East Africa, and later from the Seychelles, Comoro Islands, Zanzibar and the Somali Coast.

In the *Report* for the year 1861 it is recorded that large additions were made to the Herbarium from "Eastern Tropical Africa, by Dr. Kirk, the energetic and accomplished companion of Dr. Livingstone." During the year 1862 "Plants and drawings" were received from him from the Livingstone Expedition and in the next years live plants were sent by Dr. Kirk "collected during Dr. Livingstone's expedition, and others in the Seychelle and Comoro Islands, etc. including Fruit of the Double Cocoa-nut." In the same report Dr. Kirk's return to England in October 1863 is recorded and he came at once to Kew and was "engaged in the investigation of his large and valuable collections, both in the Museum and Herbarium."

In 1864 cases of living plants he had collected in East Africa and the Seychelles reached Kew as well as valuable additions to the collections in the Herbarium, and in 1865 Nyasa Plants.

Most of Kirk's herbarium specimens are accompanied by valuable notes and excellent pencil and coloured sketches showing habit and floral details. A large number, besides those lost in the rapids, went astray. They were sent home in a Man-of-War, and though conspicuously addressed to Kew, the cases were not discovered until 1883 in a Dockyard Store. They were then

* From what Kirk says here it is unlikely that the tree is now entirely extinct as stated in the Encycl. Brit. ed. 11. vii. 94 (1910).

delivered intact and the contents were found to be in an excellent state of preservation.

In 1867 the first consignment of Herbarium specimens from Dr. Kirk from Zanzibar was received and in the *Kew Report* for the year 1868 the receipt of " a very valuable Zanzibar Herbarium" from Dr. Kirk is recorded.

The next record of interest is in the *Report* for the year 1872 :— " Kirk, J., H.B.M.V. Consul, Zanzibar; various new and most interesting plants."

In 1873 Dr. Kirk contributed Herbarium specimens from Zanzibar and the Somali Coast and in 1877 we find his attention again directed to *Landolphia* as a source of India rubber :—

" The district called Mungao extends from lat. 9° 25′ to Delgado in lat. 10° 41′. This last year yielded £90,000 worth of india-rubber—an industry that has been created in the last two years by my representations. This year the yield will be more, and other places are now collecting it. Thus Kilwa and Mombasa will this year probably double the supply, which I anticipate will reach in value not less than £180,000 worth of india-rubber, East Africa to the south, that is from Delgado Bay to the Zambesi, is producing it as well. I must try to get the plant introduced into India, for the quality is excellent, and if grown in the coast jungles would be an addition to the sources of wealth."

Kirk's attention to a native East African Rubber tree was drawn by his seeing a native boy playing with an elastic ball, which he found was made of caoutchouc. He traced the plant from which it was obtained and so started the East African Rubber Trade (*K.B.* 1896, p. 81; *Kew Report* 1880) and incidentally that of the West Coast. In 1882 he showed specimens of *Landolphia* and balls of rubber from East Central Africa at the Linnean Society.

During the year 1879 Dr. Kirk sent to Kew three Wardian Cases from Zanzibar containing " *Euphorbia* sp., *Hypoxis villosa*, seedling and other Landolphias, *Meyenia* sp., *Keramanthus Kirkii*, *Musa Livingstoniana*, *Actiniopteris radiata*, *Pellaea Doniana* and other ferns, *Aroideae*, *Chlorophytum macrophyllum*, *Angraecum* sp., and other orchids; seeds of *Landolphia*."

In 1880 his activities and interests were again directed towards distributing the Copal tree, *Trachylobium Hornemannianum*, seed of which he had sent to Natal some five years earlier. He was also interested in the Mpafu Tree of Tropical Africa (*Canarium Schweinfurthii*, Engl.), and on p. 50 of the *Report* for 1880 some interesting particulars are given about this tree.

On a short trip up the Somali Coast he gathered some very peculiar and interesting types of plants. But for his energy, East Africa would have been poorly represented in the pages of the first three volumes of the Flora of Tropical Africa, a large number of new species having been described from his material, whilst over a hundred commemorate his name either as *Kirkii* or *Kirkiana*, including the genus *Kirkia*, Oliver

(*Simarubaceae*), and the important East African rubber vine, *Landolphia Kirkii*, Dyer.

A list of living plants introduced by Kirk from East Africa, some particulars of the garden he founded in Zanzibar, and his opinion on the advisability of establishing botanic stations in that region will be found in the *Kew Bulletin*, 1896, pp. 80–86, where also it is stated that almost every economic production of East Africa has at one time or another received attention from Sir John Kirk.

Besides his botanical work, he was an active member of the Royal Geographical Society and numerous notes and sketch-maps by him are to be found in the volumes of Proceedings and in the Journal of that Society.

Of Sir John Kirk's political achievements this is not the place to speak in detail, but it should not be forgotten that the practical suppression of the Slave Trade in East Africa was due almost entirely to his persistent efforts.

The first living contribution to Kew from Dr. Kirk was a parcel of seeds on March 3rd, 1860. After this regular consignments of plants and seeds of many kinds were received, the total number recorded being 75. Sir John was equally zealous with respect to the introduction of plants of economic interest to Zanzibar and to the mainland, and many Wardian cases and packages were despatched from Kew at his request. The following is a list of some of the plants received from him and it is of interest to record that no less than seventeen of his introductions were figured in the Botanical Magazine.

Aloe brachystachys (Bot. Mag. t. 7399).
„ Kirkii (Bot. Mag. t. 7386).
„ penduliflora.
Clerodendron cephalanthum (Bot. Mag. t. 7922).
Clerodendron macrosiphon (Bot. Mag. t. 6695).
Crinum Bainesii.
„ Hildebrandtii (Bot. Mag. t. 6709).
Crinum Kirkii (Bot. Mag. t. 6512).
Dioscorea spp.
Drimiopsis Kirkii (Bot. Mag. t. 6276).
Encephalartos Hildebrandtii (Bot. Mag. t. 8592–3).
Euphorbia spp.
Gladiolus Kirkii.
„ Quartinianus (Bot. Mag. t. 6739).
Gloriosa spp.
Haemanthus spp.
Hibiscus schizopetalus (Bot. Mag. t. 6524).
Huernia Kirkii.
Impatiens Oliveri (Bot. Mag. t.7960)
„ Sultani. (Bot. Mag. t. 6643).
Keramanthus Kirkii (Bot. Mag. t. 6271).
Kniphofia Kirkii.
Landolphia spp.
Monodora Myristica (Bot. Mag. t. 3059).
Musa Livingstonei.
„ proboscidea (Ic. Pl. t. 1777).
Neobenthamia gracilis (Bot. Mag. t. 7221).
Ochna Kirkii.
Orchids.
Palms.
Pandanus spp.
Polystachya Kirkii.
Sansevieria Kirkii (Bot. Mag. t. 7357).
Stapelia spp.
Strophanthus Kombe.
Tacca pinnatifida (Bot. Mag. t. 7299).
Vanilla Roscheri.
Virchowia africana.
Zamioculcas Boivinii (Bot. Mag. t. 6026).
„ Loddigesii (Bot. Mag. t. 5985).

He was always keenly alive to anything of exceptional interest. *Impatiens Sultani* was raised at Kew from a capsule of seed he put in his waistcoat pocket. The discovery of *Encephalartos Hildebrandtii* in 1868 (*see K.B.* 1918, p. 127), was one of his most valuable finds and he took much trouble to secure fine living specimens for Kew, which are still flourishing in the Palm House. The living plants were accompanied by his own photographs of the plant and drawings from his own hand. His last striking addition to the living collections was *Crinum natans* in 1895, when acting as special Commissioner to Nigeria whence he brought home several plants.

Sir John as might be expected was not only interested in the introduction of new and interesting plants to Kew, but was a keen gardener himself and he maintained at his own expense a fine experimental garden at Zanzibar (*K.B.* 1892, p. 87), which is fortunately still maintained by Miss C. D. M. Thackeray, the present owner. Many of the trees and shrubs planted by Sir John have reached large dimensions and Miss Thackeray in 1915 sent full particulars to Kew about some of the more interesting trees. Sir John, to whom a copy of the letter was sent, wrote, "Is it possible that the Mahogany seed I planted is now a tree 8 ft. in circumference . . . . . I wish I might again visit the place and see the result of my work. I have visited Zanzibar twice since I retired—the last time about ten years ago when I went to inspect the Uganda Railway, of the Commission for the Construction of which by the Foreign Office, I was Chairman."

It was when in Uganda on this occasion that he collected seed of *Impatiens Oliveri*, from which the stock now in cultivation was raised.

Sir John maintained his interest in gardens until the end of his life and his letters to Kew for the past 14 years were usually concerned with gardening matters despite the fact that for some years he was nearly blind and for the last few years almost completely blind. Despite this infirmity, however, he maintained his keen interest in botany and corresponded always in his own handwriting often adding at the end of his letter "Pray excuse my bad writing for you know I cannot read what I have written." Knowing Sir John, as the writer was privileged to know him for some thirty years, it was very pathetic to see him stricken with blindness and unable to appreciate fully the beauties of nature to which he was so devoted. His last letter written in October of last year has this concluding paragraph "I am ashamed to send you such an illegible letter but venture to do so in the hope you may be able to read some of it." It is remarkable how legible his later letters are though often not very easy to read. His kindliness and sympathetic interest in everything that concerned his fellows is well known and his keen sense of humour enlivened many a narrative of his experiences abroad and also we believe the experiences

themselves. He will be remembered as a public servant of rare ability and by Kew as a keen botanist, an active and accurate observer and an ever ready friend.

A. W. H.

IX.—THE "SERRATO-CILIATA" GROUP OF TROPAEOLUM.

D. K. Hughes.

When an attempt was recently made to name the Tropaeolums of Lehmann's and André's Andine collections previous to their incorporation in the Herbarium, it became necessary to revise first the older material according to Buchenau's monograph of the genus in the Pflanzenreich. No serious difficulties arose in the course of the revision until the group comprising Buchenau's species 14–29 was approached. This group is characterised by the possession of five apically serrate-ciliate petals and almost confined to the Andes of Venezuela, Colombia and Ecuador, only a few species occurring further north as far as Guatemala, or south as far as Bolivia. The affinities of the species referred to it are obvious, and the group appears therefore perfectly natural. It stands out from the remainder of the genus and may conveniently be designated by a name of its own, such as "serrato-ciliata."

The characters in which the members of this group were so far known to differ from each other are, partly foliar, namely, in the shape, size and attachment of the leaf-blades and the presence or absence of hairs on them, the length of the petioles, the development of the stipules, and partly floral, affecting mainly the size and colour of the flowers and their parts, and to a less conspicuous degree, the shape of the petals. Working on this basis it soon became evident that a number of new species would have to be added from the material at Kew, but as is usually the case with the addition of new forms, new characters had to be taken into account and studied with regard to their incidence and correlation. The more important of them were in this instance, the presence or absence of minute papillæ on the underside of the leaf-blades which make them appear more or less greyish or glaucose-pruinose, and secondly of coloured dots or mottling, usually confined to the underside of the leaf-blades or extending also to their upper side. Mr. L. A. Boodle kindly examined the leaves of some of the species with respect to those markings, and found that they were due to the presence of a colouring matter—probably tannin-mucilage—in the isolated epidermal cells, or in rows or groups of these cells. In one case (*T. papillosum*), the secretion occurred in the mesophyll, but apparently not in the epidermis. A priori one would not attach much importance to those characters, but a careful scrutiny of the material at hand has shown that they are so

connected with other characters that they appear to form an essential part of the specific constitution of the species. Unfortunately the number of pieces of most of the species under observation is very small, nor was there any living material available, for it seems that these pretty plants are difficult to cultivate.

The range within which the characters used for discrimination actually vary, and consequently their reliability and ultimately perhaps even the claim of some of the units recognised to the status of species remain therefore open questions. Observations in the field and cultivation both have to be called in aid to answer them. Meanwhile, an adequate description of the members of the group and a clear disposition of their distinctive characters will not only prepare a sound foundation for such field and experimental work, but also serve for the immediate practical need of a ready means for determining Tropaeolums of the serrato-ciliata group. With this end in view I asked Miss Hughes to prepare, under my supervision, the revision which forms the subject of the present paper.

O. Stapf.

Key to the Species.

*Blades pruinose papillose below, or if epapillose then without red dots or mottling :
  Stipules leafy, conspicuous, persistent, semiorbicular, 1 cm. in diameter - - - - - 1. *Matthewsii.*
  Stipules inconspicuous, deciduous or wanting :
    †Blades glaucous and pruinose papillose below :
      Blades hairy on both sides, rotundate ovate and bluntly 5-lobed to subentire :
        Flowers 2-2·5 cm. long, hairy 2. *pubescens.*
        Flowers 3·5–4·5 cm. long, glabrous :
          Petiole stout, shorter than the blades which are densely white-papillose below; flowers 3·5 cm. long - - 3. *papillosum.*
          Petiole filiform, stout at the base, longer than the blades which are greyish-pruinose below; flowers 4·5 cm. long - - 4. *hirtifolium.*

Blades like the petioles and flowers quite glabrous :
Blades shorter than broad :
Flowers 5 cm. long; blades only slightly shorter than broad (ratio 1 : 1·3), distinctly 5-lobed, or the lower sinuses indistinct or obsolete — 5. *menispermifolium*.
Flowers 2–3 cm. long; blades much shorter than broad (ratio 1 : 3) :
Spur of flower very slender, about 2·5 mm. broad at the mouth, tapering to an extremely fine tip; sepals much spreading and exceeded by the long fimbrii of the petals :
Leaves subentire, ellipsoid, each primary nerve terminated at the margin by a fine mucro; flowers scarlet - - 6. *Fintelmannii*.
Leaves shallowly 5-lobed, lobes mucronate; flowers pale (yellow?) - 7. *Warscewiczii*.
Spur of the flower cylindrical, 3–4 mm. broad at the mouth, hardly tapering to the blunt apex; sepals rarely exceeded by the very short fimbrii of the petals; leaves distinctly lobed, concave at the base - 8. *bimaculatum*.
Blades longer than or as long as broad; flowers 4·5–5·5 cm. long :
Blades distinctly peltate :
Blades triangular, lateral angles somewhat obtuse, terminal blunt or acute but not acuminate; base truncate or slightly concave; flowers slender, diameter of the base of the spur about 4 mm. :
Petioles shorter (2·5–3 cm.) than the blades;

pedicels 7–10 cm. long; flowers 5–5·5 cm. long — 9. *Kuntzeanum.*

Petioles longer (7–10 cm.) than the blades; pedicels 18–20 cm. long:

Blades longer than broad (ratio 3·4 : 2·3); petiole inserted in the ratio of 4 : 1; flower 4·5 cm. long — 10. *cirrhipes.*

Blades triangular, as long as broad; petiole inserted near the margin in the ratio 9 : 1; flowers up to 5·5 cm. long — 11. *Traceyae.*

Blades ovate-acuminate, rounded at the base; diameter of the base of spur about 7 mm. — 12. *Lehmannii.*

Blades hardly peltate with the insertion of the petiole near the margin, or not peltate at all:

Blades rather longer than broad, triangular-hastate, with obscurely and irregularly lobed or wavy sides; pedicels 7 cm. long — 13. *Wagenerianum.*

Blades as long as broad or very slightly longer; pedicels 15 cm. to over 20 cm. long:

Lateral angles and apex very blunt, the former broad and rounded; pedicels very slender — 14. *Karstenii.*

Lateral angles and apex sharply acute, the latter cuspidate; pedicels rather stout — 15. *cuspidatum.*

††Blades epapillose, smooth below, quite glabrous:

Flowers hairy (at least the sepals), 4·5–5 cm. long; blades usually sub 3–5-lobed with the terminal lobe produced and ± acute; petioles 3–10 cm. long; pedicels 5–15 cm. long — 16. *Deckerianum.*

Flowers glabrous :
Flowers 3·7–5 cm. long; blades entire or obscurely 3-lobed, ovate to rotundate-ovate, longer than broad, obtuse or subacute, usually dark green above and purplish below, pale along the nerves on both sides - - - 17. *Lindenii.*
Flowers 2–4 cm. long :
Flowers 3·5–4 cm. long; blades shallowly and equally 5-lobed - - - 18. *Daweii.*
Flowers 2–2·5 cm. long; blades 3-lobed or if obscurely 5-lobed then the lower sinuses obsolete - - 19. *crenatum.*

**Blades punctate or mottled with red, not papillose below :
Blades distinctly hairy :
Blades tomentose below, ovate-acuminate with a sharp point above the middle on either side (ratio 1 : 0·8) stem at first tomentose, soon glabrescent; petioles stout, tomentose; flowers 4·5 cm. long - 20. *tomentosum.*
Blades fulvously hairy but not tomentose, petioles slender :
Blades entire or the lobes reduced to small teeth :
Blades orbicular or depressed orbicular, 1 cm. long by 1–1·4 cm. wide; stem fulvously tomentose at the nodes, the rest glabrous or sub-pubescent; flowers 4·5–5 cm. long 21. *parvifolium.*
Blades ovate-obtuse, larger; stem spreadingly hairy; flowers 3 cm. long - - 22. *fulvum.*
Blades shallowly 3–5-lobed :
Blades depressedly rotundate-ovate, ratio 1 : 1–1·25, copiously red punctate below on a dark ground, 5-lobed, lobes subcrenulate, rounded, spur 4 times the length of the sepals - - - - 23. *pseudopubescens.*
Blades broadly ovate (ratio 1 : 0·8) very sparingly red punctate on a whitish ground

usually 3-lobed, lobes often subacute, the terminal triangular; spur 6 times the length of the sepals - - 24. *adpressum.*

Blades and petioles glabrous or almost so :

Stems spreadingly hairy especially at the nodes; blades entire or obscurely lobed; flowers glabrous :

Stipules inconspicuous, deciduous; flowers 4–5·5 cm. long; blades longer than broad, acute or acuminate, rounded at the base :

Blades ovate-acute, obscurely lobed with the terminal lobe triangular or entire; flowers up to 5·5 cm. long - - 25. *coccineum.*

Blades oblong-lanceolate, entire; flowers 4–4·5 cm. long - 26. *longifolium.*

Stipules conspicuous, leafy, orbicular, about 10 mm. in diameter; flowers 2·5 cm. long; blades shorter than broad (ratio about 4 : 4·5), obscurely but equally 5-lobed, base slightly concave - - - - 27. *stipulatum.*

Stems quite glabrous; leaves bluntly 3–5-lobed :

Flowers 3·5–4·5 cm. long; blades densely mottled or dotted with red on a dark ground :

Flowers hairy (at least the sepals), 4·5 cm. long; blades shallowly and very obtusely 5-lobed, ratio 1 : 11 - - 28. *maculifolium.*

Flowers glabrous; blades entire or almost so :

Flowers 4·5 cm. long; blades subentire (ratio 1 : 1–0·8) - - - 29. *integrifolium.*

Flowers 3·5 cm. long; blades shallowly 5-lobed (ratio 1 : 1·2) - - - 30. *kerneisinum.*

Flowers 2·5–3 cm. long; blades mottled on a pale ground :

Blades 5-lobed, pentagonal, base concave, primary lateral nerves straight, terminal lobe ovate - - - - 31. *pentagonum.*

Blades 3-lobed, base convex, margins subcrenulate, primary lateral nerves curved - - 32. *trilobum*.

ENUMERATION.

All the specimens quoted in this paper have been seen by me.

1. **T. Matthewsii,** *Hughes*, nov. sp. (Page 70, fig. A.)

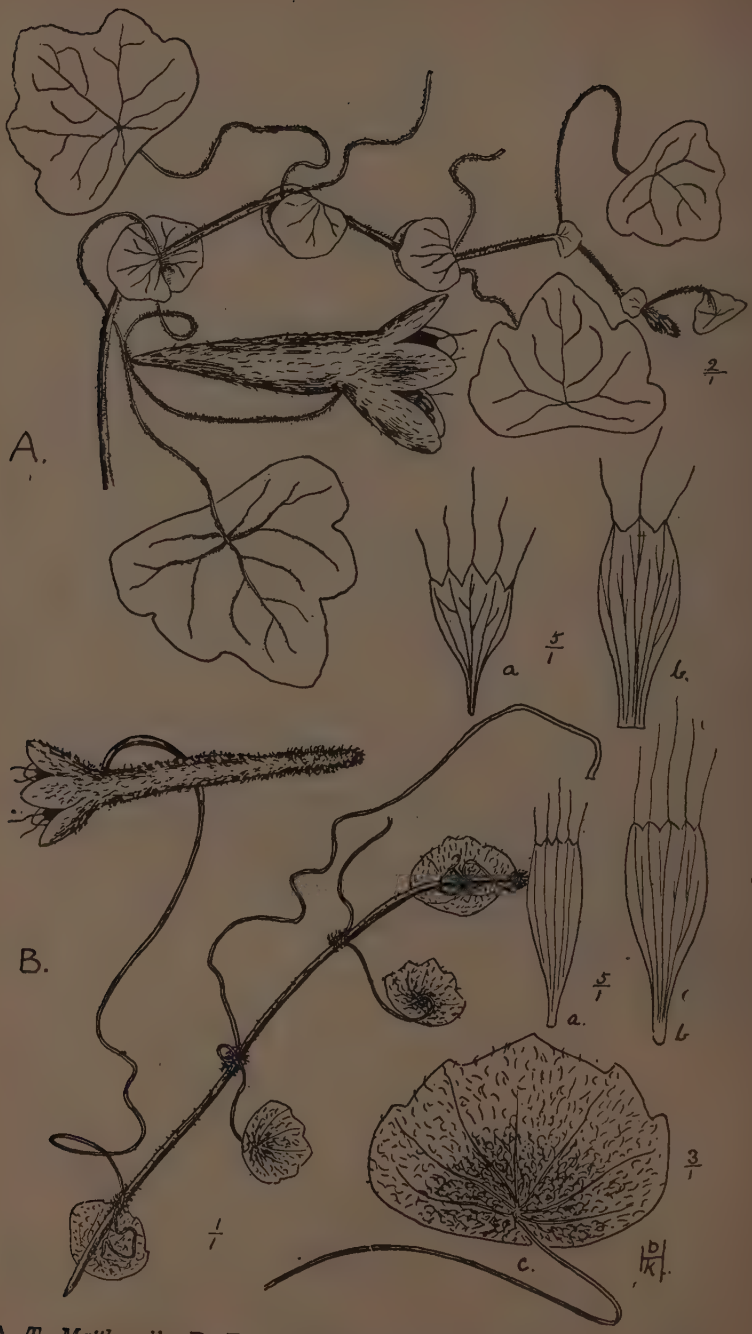
Herba scandens, novellis araneoso-villosis citissime magis minusve puberulis. *Caulis* gracilis, inferne plus minusve teres, apicem versus compressus et contortus. *Folia* egregie stipulata; *stipulae* persistentes, semiorbiculares, usque ad 1 cm. diametro, integrae vel inconspicue crispae, supra vix papillosae, subtus pruinoso-papillosae; *petioli* graciles, subcirrhosi, fere 3 cm. longi; *laminae* late triangulari-ovatae, 2·5–3 cm. longae lataeque vel paulo latiores, supra vix papillosae, subtus pruinoso-papillosae, partibus suprapetiolari et infrapetiolari ratione 5 : 1, breviter lataeque quinquelobae, lobis emucronatis, integris vel inconspicue crispis. *Pedicelli* gracillimi, cirrhosi, vix petiolos superantes. *Flores* sparse pubescentes, usque ad 2·5 cm. longi; *calcar* rectum, conicum, usque ad 1·8 cm. longum, basi circiter 4 mm. diametro; *sepala* obtusa, ovato-oblonga; *petala* haud exserta, parva, superne dentato-ciliata, superiora late spathulato-oblonga, 6 mm. longa, inferiora obtriangularia in unguem attenuata, 4 mm. longa.

PERU: Chachapayos, *Matthews*.

2. **T. pubescens,** *H. B. & K.*, Nov. Gen. et Spec. v (1821) 251.

Herba scandens. *Caulis* gracilis, curvatus, plus minusve angulosus et sulcatus, pilis fulvis (praecipue prope nodos) usque ad 1 mm. longis hirsutus. *Folia* stipulata; stipulae minutae, angustatae, usque ad 1 mm. longae, apice dentatae vel crenulatae, deciduae, glabrae; petioli subrobusti, curvati, saepe cirrhosi, laminas subaequantes vel excedentes, usque ad 10 cm. longi, pilis fulvis dense hirsuti; *laminae* late triangulari-ovatae, 2–6 cm. longae lataeque vel paulo latiores, saepe pilis albis minutissimis pubescentes et pilis fulvis dispersis ad 1 mm. longis indutae, supra intense virides, subtus pallidiores, subglaucae, minute pruinoso-papillosae, partibus suprapetiolari et infrapetiolari ratione 5 : 1, breviter lataeque quinquelobae, lobis emucronatis, integris vel inconspicue crispis. *Pedicelli* gracillimi, cirrhosi, petiolos vix superantes. *Flores* fulve-hirsuti, 2–2·5 cm. longi; *calcar* rectum, conicum, circiter 1·6 cm. longum, basi 3–5 mm. diametro, rubrum, apice obtusum; *sepala* rotundato-ovata, viridia; *petala* haud exserta, 5 mm. longa, spathulato-oblonga, superne 4–5-dentato-ciliata, atro-caerulea.

COLOMBIA: New Grenada, *Linden* 923; *Holton* 885; *Triana* 3775; Pasto, *Jameson;* and without precise locality, *Lobb* 17; Cundinamarca, Facatativa, hacienda La Selva, 2440 m., *Mrs. Tracey*.



A. ***T. Matthewsii.*** **B.** ***T. parvifolium.*** a. petalum inferius. b. petalum superius. c. leaf of *T. parvifolium.*

Ecuador: Quito, *Jameson*; Miligalli, 1768 m., *André*; Banos, *Spruce* 4985; Tambo de Quinoa, *Seeman* 886.

Eastern Andes: *Veitch's Collector* 358.

3. **T. papillosum,** *Hughes*, nov. sp. (Page 72, fig. A.)

Herba scandens, glabra. *Caulis* gracilis, striatus, subcompressus et contortus. *Folia* estipulata; petioli robusti, inferne satis incrassati et cirrhosi, quam laminas breviores, usque ad 4 cm. longi; *laminae* subintegrae, late rotundato-ovatae, 6·5 cm. longae lataeque, partibus suprapetiolari et infrapetiolari ratione 3 : 1, supra virides, rubro-punctatae, papillosae et sparse pubescentes, infra glaucae, obscure marmoratae, dense pruinoso-papillosae. *Pedicelli* gracillimi, vix cirrhosi, petiolos superantes, usque ad 7 cm. longi. *Flores* glabri, fere 3·5 cm. longi; *calcar* rectum, cylindrico-conicum, apice abrupte attenuatum, 2·5 cm. longum, basi 4 mm. diametro; *sepala* ovata; *petala* dentata, haud exserta, 4·5 mm. longa, superiora spathulato-oblonga, longe ciliata, inferiora minora, breviter ciliata.

W. Tropical S. America. Ecuador? Tambo grande, 24 Oct. 1876, *André*.

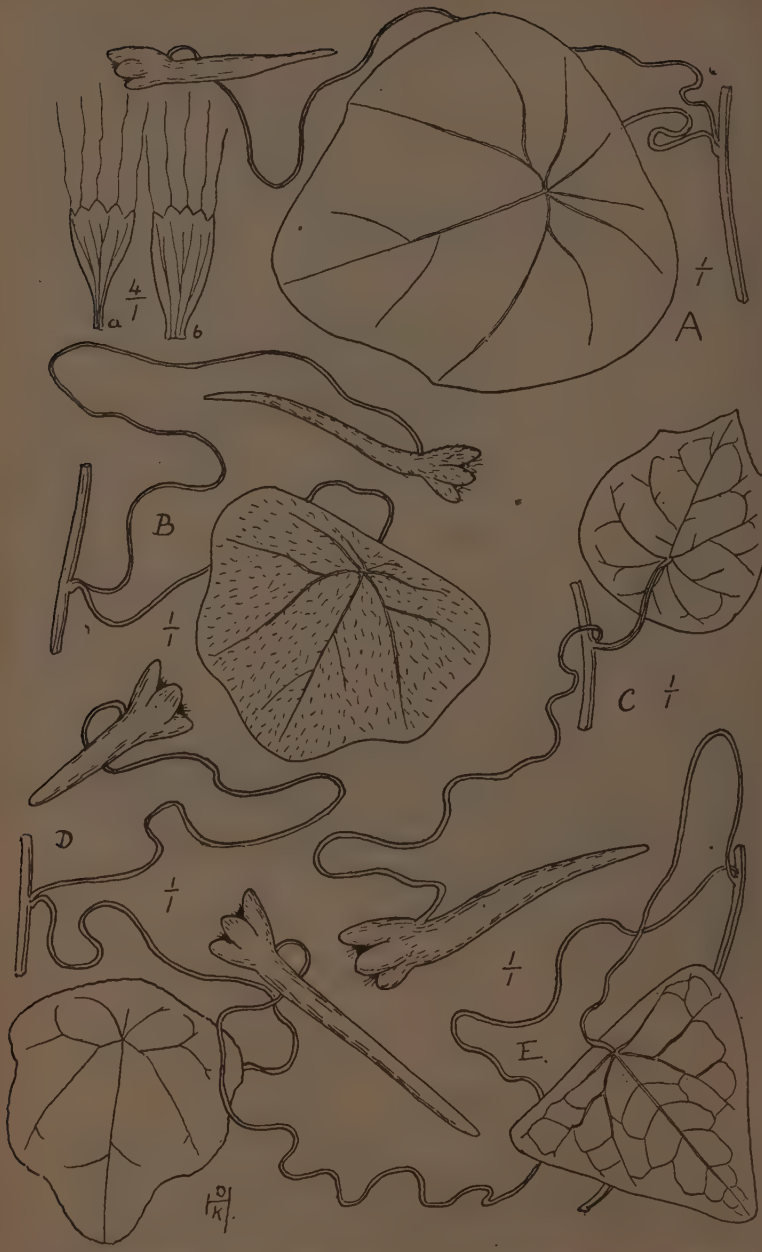
4. **T. hirtifolium,** *Hughes*, nov. sp. (Page 72, fig. B.)

Herba scandens. *Caulis* gracilis, striatus. *Folia* estipulata; *petioli* glabri, graciles, basin versus sensim modice incrassati, subcirrhosi, quam laminas longiores, usque ad 8 cm. longi; *laminae* hirsutae, breviter lateque subquinquelobae, lobis obsolete mucronatis, circiter 3·5–7·5 cm. longae, 4·5–10 cm. latae, partibus suprapetiolari et infrapetiolari ratione 8 : 1, nec marmoratae nec punctatae, supra viridis, infra cinereo-papillosae. *Pedicelli* glabri, gracillimi, cirrhosi, vix petiolos superantes. *Flores* penduli, pubescentes, ad minimum sepala, usque ad 4·5 cm. longi; *calcar* coccineum, angustum, subcurvatum, 3·5 cm. longum, basi 3 mm. diametro; sepala viridia ovato-oblonga; *petala* haud exserta, 4·5 mm. longa, superne dentato-ciliata fimbriis nigris.

Colombia: Prov. Antioquia, 5490 m., borders of forest, *Kalbreyer* 1455.

5. **T. menispermifolium,** *Buchenau* in Engl. Jahrb. xxxiv Beibl. lxxviii, 11.

Herba alte scandens. *Caulis* obtusangulus, sulcatus, diametro 2 mm., griseo-pubescens. *Folia* estipulata; *petioli* curvati, sed rarius cirrhosi, 5 usque 7 cm. longi, griseo-pubescentes; *laminae* latiores quam longiores, repando-quinquelobae, basi vadoso-repandae, sino laterale inferiore vadosissimo, superiore distinctiore sed etiam vadoso, obtusangulae, apice rotundatae, partibus suprapetiolari et infrapetiolari ratione 6 usque 7 : 1, supra intense virides, subtus griseo-virides, dense pruinoso-papillosae, glabrae. *Pedicelli* foliis longiores, filiformes, sub flore incrassati, curvati,



A. *T. papillosum.* B. *T. hirtifolium.* C. *T. Lehmannii.* D. *T. Daweii.* E. *T. Traceyae.* a. petalum inferius. b. petalum superius. The petals of B. C. D. and E. are similar to those figured for A. differing only slightly in size (*see* descriptions).

saepe cirrhosi, subpubescentes. *Flores* circiter 5 cm. longi; *calcar* conico-subulatum, puniceum (?), supra 4·5, infra 4·1 cm. longum, basi 8 mm. diametro, glabra; *sepala* circiter 5 mm. longa, oblonga, rotundata, virida (?); *petala* parva, usque ad 5 mm. longa, vix exserta, superne serrato-ciliatae, probabiliter rubro-violacea.

Ecuador: Angamarca near Pangoa, *Sodiro* 227.

6. **T. Fintelmanni,** *Wagener* in Allg. Gartenz., xviii (1850) 105.

Herba scandens. *Caulis* gracilis, curvatus, plus minusve angulosus et sulcatus, glaber vel interdum sparse pubescens. *Folia* estipulata; *petioli* tenuissimi, curvati, basi cirrhosi et sparse pubescens, caeterum glabri, usque ad 6 cm. longi; *laminae* depresso-orbiculares, 2–3 cm. longae, 4–5 cm. latae, integrae vel vadissime et indistincte lobatae, lobis apicis mucronatis, partibus suprapetiolari et infrapetiolari ratione 8 : 1, supra virides, subtus glaucae et minute pruinoso-papillosae, glabrae. *Pedicelli* petiolos vix excedentes, tenuissimi, cirrhosi, glabri. *Flores* coccinei, 2·5–3 cm. longi; *calcar* rectum vel leviter curvatum, e basi cylindrica subulatum, apice leviter attenuatum, circiter 1·8 cm. longum, basi 3·5 mm. diametro; *sepala* rotundato-oblonga, obtusa, usque fere 8 mm. longa; *petala* non exserta, 6 mm. longa, atroviolacea, superne dentato-ciliata. superiora late spathulato-oblonga, inferiora late obtri angularia in unguem longum anguste contracta.

Venezuela: Caracas, Galipan, 1830 m., *Herb. Otto Kuntze* 1498.

Colombia: Cauca, Las Pavas, Quindio, *André* 2363; Rio dos Brazos, *André* 2798.

7. **T. Warscewiczii,** *Buchenau* in Engl. Jahrb. xxvi (1899) 582.

Herba scandens, probabiliter etuberifera, glabra. *Caulis* angulosus, diametro usque 1 mm. *Folia* stipulata; *stipulae* tenerae, lineares; *petioli* graciles, laminae saepe longiores, 2 usque 3 cm. longi, plerumque curvati, rarius cirrhosi; *laminae* latiores quam longiores (circiter 1 : 1·3) basi fere truncatae, margine quinque-sinuato-lobatae, incisuris obtusangulis, apice mucronata, partibus suprapetiolari et infrapetiolari ratione 12 : 1, supra intense virides, subtus pallidiores, dense pruinoso-papillosae. *Pedicelli* gracillimi, curvati, interdum cirrhosi. *Flores* 3·7 usque 3·8 mm. longi; *calcar* rectum, cylindrico-subulatum, 2·1 usque 2·2 mm. longum, basi diametro 2 mm., flavum; *sepala* ovoidea, obtusiuscula, circiter 5 mm. longa, probabiliter flava; *petala* circiter 7 mm. longa, calycem vix superantia, albo-flavida, crenato-ciliata, superiora late stipitata, rotundato-ovalia, apice superne dentata, 5-ciliata, inferiora anguste stipitata, ovalia, marginibus pluri-(circiter 15) dentato-ciliata.

Central America: Costa Rica and Veragua, *Warscewicz*.

There seems to be very little difference between this species and *T. Fintelmannii*, Wagener, apart from the shape of the leaves which are here decidedly more deeply lobed, and the colour of the flowers. In absence of good material of *T. Warscewiczii* it is not possible to decide whether it is really a distinct species.

8. **T. bimaculatum,** *Klotzsch ex Buchenau* in Engl. Jahrb. xv (1892) 217.

Herba alte scandens, glabra, probabiliter non tuberifera. *Caulis* tenuis, diametro usque 1·25 mm. (et ultra). *Folia* stipulata; stipulae tenerrimae, parvae, subulatae (interdum bifidae), deciduae; *petioli* graciles, diametro 0·2 usque 0·35 mm., subcirrhosi; *laminae* subpeltatae, reniformi-semiorbiculares, usque 3 raro fere 4 cm. latae et 2 raro 2·4 cm. longae, partibus suprapetiolari et infrapetiolari ratione 8:1, basi truncatae vel levissime repandae, quinquelobae, incisuris plerumque obtusis, plus minusve repandis (usque $\frac{1}{4}$ insecantes), lobis rotundato-obtusis, distincte mucronatis, subtus dense pruinoso-papillosae. *Pedicelli* foliis longiores, gracillimi, subcirrhosi. *Flores* circiter 2·7 cm. longi; *calcar* rectum, cylindrico-attenuatum, 1·7–1·85 cm. longum; *sepala* late oblonga, obtusissima, interdum mucronata, circiter 8 mm. longa; *petala* sepalis aequilonga, circiter 8 mm. longa, obovato-cuneata, apice serrato-aristata (aristis 8 usque 10), superiora latiora, inferiora angustius unguiculata.

Central America: Chiriqui and Carthago-Vulkan, *Warscewicz*.

9. **T. Kuntzeanum,** *Buchenau* in Engl. Jahrb. xxii, 163.

Herba alte scandens (usque 3 m.), glabra. *Caulis* tenuis, 1–1·25 mm. diametro, debilis. *Folia* estipulata; *petioli* tenues, debiles, lamina breviores, 2·5–3 cm. longi; *laminae* triangulares, integerrimae, basi subrepando, angulis basilaribus rotundatis, lateribus curvatis, circiter 3·5–4 cm. longae et basi 2·5 cm. latae, apice acuto, subtus glaucae, papillis squamuliformibus indutis, distincte venosae. *Pedicelli* graciles, debiles, folio multo longiores, 7 usque 10 cm. longi. *Flores* 5 usque 5·5 cm. longi; *calcar* fere rectum, cylindrico-conicum, apice rotundatum et leviter inflatum, circiter 4·5 cm. longum, pallide rubrum (apice viride?); *sepala* ovato-triangularia, aequilonga, obtusiuscula, viridia; *petala* calyce breviora, subaequalia (superiora lateriora), rhomboideo-cuneiformia, apice 5–7-dentato-aristata, saturate indigotica.

Bolivia: Paulo Rosa and La Seja, *Otto Kuntze*.

10. **T. cirrhipes,** *Hook.*, Icon. Pl. v. (1842), t. 411.

Herba scandens, praeter nodos hirsutos glabra. *Caulis* gracilis, angulosus et sulcatus. *Folia* estipulata, vel stipulis minutissimis deciduis praedita; *petioli* curvati vel cirrhosi, usque

ad 11 cm. longi; *laminae* elongato-triangulares, integrae, angulis basilaribus rotundatis, apice obtusa, basi subrepando, lateribus leviter curvatae, usque ad 9 cm. longae et basi 5–6 cm. latae, partibus suprapetiolari et infrapetiolari ratione 2·5 usque 3 : 1, supra virides vel prope nodos violaceae, subtus glaucae, obscure vel minutissime pruinoso-papillosae. *Pedicelli* gracillimi, valde cirrhosi, usque ad 20 cm. longi, sub flore leviter incrassati. *Flores* 4·5 cm. longi; *calcar* cylindricum, coccineum, 3·6 cm. longum, basi diametro 4 mm., apice obtusum; *sepala* rotundato-ovata, viridia; *petala* non exserta, 4–5 mm. longa, superne dentato-ciliata, luteo-viridia.

Peru: Chachapayos, *Matthews* 3177.

11. **T. Traceyae,** *Hughes*, nov. sp. (Page 72, fig. E.).

Herba scandens, glabra. *Caulis* gracilis, triquater, contortus. *Folia* estipulata; *petioli* subrobusti, inferne satis incrassati et cirrhosi, quam laminas longiores, usque ad 7 cm. longi; *laminae* aequilateraliter triangulares, integrae, angulis basilaribus rotundatis, apice abrupte acutae vel subobtusae, 3–4·5 cm. longae lataeque, supra laeves, virides, subtus glaucae, minutissime papillosae, partibus suprapetiolari et infrapetiolari ratione 9 : 1. *Pedicelli* gracillimi, valde cirrhosi, usque 18 cm. longi. *Flores* 4·5–5·5 cm. longi; *calcar* rubrum, rectum vel sub-rectum, cylindrico-conicum, basi diam. 4–6 mm.; *sepala* oblonga, obtusiuscula, viridia; *petala* vix exserta, 4·5 mm. longa, dentato-ciliata, ciliis ad 5 mm. longis, superiora obovato-oblonga, inferiora obtriangularia in unguem attenuata.

Colombia: Gundinamarca, La Mesa, edge of forest El Colegio, 1220 m., *Mrs. Tracey*, 164.

12. **T. Lehmannii,** *Hughes*, nov. sp. (Page 72, fig. C.).

Herba scandens, glabra. *Caulis* gracilis. *Folia* estipulata; *petioli* graciles, vix cirrhosi, 2–2·5 cm. longi; *laminae* late ovatae, acuminatae, subintegrae vel insconspicue crispo-crenulatae, 3–3·5 cm. longae, 2·6–3 cm. latae, supra laeves, subtus pruinoso-papillosae, partibus suprapetiolari et infrapetiolari ratione 3 : 1, rubro-marmoratae. *Pedicelli* gracillimi, basi cirrhosi, 6–7 cm. longi. *Flores* 4–5 cm. longi; *calcar* subrectum, conicum, ad apicem attenuatum, 3·5–4 cm. longum, basi ad 7 mm. diametro; *sepala* elliptico-oblonga; *petala* vix exserta, superne dentato-ciliata, 5 mm. longa.

Colombia: Cauca, Paramo de Ruiz. *Lehmann* 3103. A specimen in the Natural History Museum—*Triana* (1829–1890)—with no locality given, resembles this species closely, but differs in having larger leaves, (5–7 cm. long, 3·5–4·5 cm. wide) which are apparently not mottled and larger flowers (5·5 cm. long).

13. **T. Wagnerianum,** *Karst.* in All. Gartenz. xviii (1849) 305.

Herba scandens, etuberosa, glabra. *Caulis* gracilis, curvatus. *Folia* estipulata; *petioli* flexuosi vel cirrhosi, quam laminas

longiores (?); *laminae* triangulari-hastatae, longiores quam latiores, usque ad 6 cm. longae, anguste peltato-affixae, partibus suprapetiolari et infrapetiolari ratione 27 : 1, acuminatae, acutae, lobis baseos saepe truncatis hinc rotundatis, illinc (extrorsum) angulo obtuso terminatis, margine leviter incrassato, plus minusve inaequaliter sinuata, supra intense virides, subtus pallidiorae, pruinoso-papillosae, glaucae. *Pedicelli* folia longe superantes, usque 7 cm. longi. *Flores* 4·5 cm. longi; calcar cylindrico-conicum, leviter incurvatum, supra 3·5 (infra 3·0) cm. longum, basi diametro 1 cm., coccineum, apice viride; *sepala* late-ovata, acuta, viridia; *petala* calycem paulo superantia, caeruleo-violacea, superne fimbriata. *T. Schlimmii*, Linden. ms.

Venezuela: Trujillo, 2133 m., *Linden* 1431 (Herb. Planch.)

Colombia (?).

14. **T. Karstenii,** *Wagner* in Oesterr. Bot. Zeitschr. lviii (1908) 436.

Herba scandens, glabra. *Caulis* gracilis, plus minusve angulosus et sulcatus. *Folia* estipulata; *petioli* subrobusti, laminae longiores, usque 10–14 cm. longi; *laminae* fere semiorbiculari-triangulares angulis obtusis, vix longiores quam latiores, usque 9 cm. longae, anguste peltato-affixae, partibus suprapetiolari et infrapetiolari ratione 18 : 1, basi leviter curvato-excisae, supra sparse, subtus densissime, minute pruinoso-papillosae. *Pedicelli* tenuissimi, flexuosi et cirrhosi, foliis multo longiores, minime 20 cm. longi. *Flores* incogniti.

Colombia: Bogota, *Karsten.*

This species, the flowers of which are unknown, was compared by Dr. Wagner with *T. cirrhipes*, Hook. From this it is clearly distinguished by having the insertion of the petiole very near the margin. Its nearest ally seems to be *T. Wagenerianum*, Karst., which has relatively narrower leaves and much shorter pedicels. But in the total absence of flowers it is not possible to place it with absolute certainty.

15. **T. cuspidatum,** *Buchenau* in Engl. Jahrb. xxvi (1899) 581.

Herba scandens, etuberosa, glabra. *Caulis* angularis, genuflexus, 1·5 usque 2 mm. diametro. *Folia* estipulata; *petioli* graciles, saepe curvati, rarius cirrhosi, 3·5 usque 6 (raro 7) cm. longi, diametro circiter 1 mm.; *laminae* indistinctissime peltatae, fere semiorbiculari-triangulares, vix longiores quam latiores, integerrimae, basi curvato-excisae, supra laeves, subtus minute pruinoso-papillosae, angulis basilaribus rectis, lateribus infra medium convexis, supra medium concavis et in acumen 6 usque 8 mm. longum productis. *Pedicelli* foliis multo longiores (16 usque 20 cm. longi), petiolis crassiores, curvati sed vix cirrhiformes. *Flores* 5·2 cm. longi; *calcar* cylindrico-conicum, obtusum, usque ad 4 cm. longum, basi circiter 7 mm. diametro; *sepala* erecta, latissime ovata (fere semiorbicularia), obtusa;

petala calycem vix superantia, ovalia, basi cuneata, apice serrato-ciliata, nigro-caerulea, 7–8 mm. longa. *T. infundibularum*, Rusby in Bull. N. Y. Bot. Gard. iv (1907) 336.

Bolivia: Uchimachi, Coroico, *Miguel Bang* 2354.

16. **T. Deckerianum,** *Moritz & Karst.* in Karst. Ausw. Neu. Gew. Venez. (1848) 38 t. 12.

Herba scandens, subpubescens. *Caulis* angulosus, sulcatus, ad nodos pilis albis ad 2 mm. longis pilosus, caeterum glabrescens. *Folia* estipulata, vel stipulis minutis deciduis instructa; *petioli* laminas plus minusve aequantes, basis pilosi, caeterum glabrescentes, curvati vel vix cirrhosi; *laminae* ovato-triangulares, 4–8 cm. longae vel longiores, 3–7 cm. latae, partibus suprapetiolari et infrapetiolari ratione 3·5 : 1, basi rotundatae, apice acutae, subquinquelobae, lobis lateralibus plerumque multo reductis, lobo terminale elongato-triangulare, supra luteo-virides, subtus vix pallidiores, epapillosae. *Pedicelli* tenerrimi, 5–15 cm. longi, valde cirrhosi, glabri. *Flores* albo-pilosi, 4·5–5 cm. longi; *calcar* rectum vel leviter curvatum, 3–4 cm. longi, basi diametro 3·5–8 mm., rubrum, apice acuto, viride; *sepala* late ovata, viridia, valde pilosa; *petala* dentata, superne longe fimbriato-ciliata, atro-caerulea, 6 mm. longa, superiora late spathulato-oblonga, inferiora angustiora. *T. trilobum*, Turcz. in Bull. Soc. Nat. Moscow xxi (1858) 424.

N. Colombia: Tovar, *Fendler* 149; *Moritz* 1676; New Grenada, Ocana, *Schlim* 355; and without precise locality, *Burke*.

17. **T. Lindeni,** *G. Wallis* in Ill. Hort. sér. 6, i (1894) 267 t. 17.

Herba alte scandens. *Caulis* gracilis, angulosus, curvatus, saepe atroruber, pilis fulvis (praecipue prope nodos) ad 3 mm. longis indutis. *Folia* estipulata; petioli subrobusti, laminas aequantes vel excedentes, ad 14 cm. longi, glabri vel basis pilis albo-fulvis induti; *laminae* pentagoni-ovatae, vel interdum ovatae, longiores quam latiores, basi rotundatae, lobo terminale triangulare, obtuso vel subacuto, lobis lateralibus plerumque bosoletis, supra medium unisinuatae, partibus suprapetiolari et infrapetiolari ratione 2 usque 3 : 1, utrinque glabrae et epapillosae, purpureo-marmoratae, ad nervos pallidiores. *Pedicelli* longissimi, gracillimi, usque ad 22 cm. longi, cirrhosi, glabri. *Flores* 4·5–5 cm. longi, glabri; *calcar* rectum, conicum, 3·5–3·8 cm. longum, rubrum, basi 8–9 mm. diametro; *sepala* oblonga, 8–10 mm. longa, 4 mm. lata, viridia; *petala* rubro-violacea, usque 8 mm. longa, superne dentata, longe fimbriata, fimbrii ad 9 mm. longi, superiora oblonga, fere ligulata, basi vix attenuata, inferiora obtriangularia, in unguem longe attenuata.

Colombia: Antioquia, above Robledo near Medellin, 1500–1700 m., *Lehmann* 5870; and without precise locality *Sanders* 1881; *Jervise*; New Grenada, Mariquita, Quindio, 1600 m., *Triana* 3778; Bogota, Fusugasuga, *Hartweg*.

18. **T. Daweii**, *Hughes*, nov. sp. (Page 72, fig. D).

Herba scandens. *Caulis* gracilis ad nodos pubescens, caeterum glaber vel glabrescens. *Folia* estipulata; *petioli* glabri, graciles, demum incrassati, subcirrhosi, circiter 5 cm. longi; *laminae* glabrae, rotundato-ovatae, late repando-quinquelobae, lobis emucronatis, 3·5–4 cm. longae lataeque vel paulo latiores, partibus suprapetiolari et infrapetiolari ratione 3 : 1, epapillosae. *Pedicelli* gracillimi, subcirrhosi, vix petiolos superantes. *Flores* glabri, 3–3·5 cm. longi; *calcar* rectum, conicum, usque ad 2·5 cm. longum, basi 5 mm. diametro; *sepala* late elliptica vel ovata; *petala* haud exserta, superne dentato-ciliata, atrocaerulea, superiora spathulato-oblonga, 5 mm. longa, inferiora obtriangularia in unguem attenuata, 4·5 mm. longa. *T. Deckerianum*, Triana and Planchon, Prod. Fl. Nov. Gran. in Ann. Sc. Nat. Sér. 5, p. 119. non Moritz.

Colombia: Eastern Cordillera, *Dawe* 855; Bogota, 2700 m. *Triana* 3776; Prov. Mariquita, forests of Quindio, 2500 m. *Triana* 3777, 6063/5, 6063/6.

19. **T. crenatum**, *Karst.*, Fl. Colomb. i (1858–61) 145 t. 72.

Herba scandens, glabra; radice fibrosa. *Caulis* angulosus, lignescens, leviter sulcatus. *Folia* stipulata; *stipulae* minutae, hyalinae, subovales, obliquae, basi lata sessiles, laciniatae; *petioli* curvati, interdum cirrhosi, ad 7 cm. longi; *laminae* subrotundato-ovatae, apice obtusae, in utroque latere repandae vel sinuato-trilobae, lobis lateribus brevibus, latis, obtusissimis, majores 5–7 cm. longae lataeque, supra saturate virides, subtus pallidae, epapillosae, partibus suprapetiolari et infrapetiolari ratione 4·5–5 : 1. *Pedicelli* petiolorum longitudine vel breviores, teretes, glabri, cirrhosi. *Flores* usque ad 2·6 cm. longi; *calcar* rectum vel leviter curvatum, conicum, usque ad 1·8 cm. longum, apice obtusum; *sepala* ovata, apice rotundata; *petala* lateobovato-cuneata, superne dentato-fimbriata, violacea, superiora usque ad 4 mm. longa, inferiora paulo longiora.

Venezuela: Caracas, *Linden* 347; *Funcke* and *Schlim* 1394 (e descr.).

Colombia: Merida 2000–2500 m., *Karsten* (fragm. typ.); New Grenada, near San Miguel, Nevada de Santa Marta, *Purdie* (e descr.).

20. **T. tomentosum**, *Hughes*, nov. sp. (Page 81, fig. A.).

Herba scandens. *Caulis* subrobustus, quadrangularis, contortus, ad nodos fulve-tomentosus, caeterum subpubescens. *Folia* estipulata; *petioli* cirrhosi, robusti, fulve-tomentosi, haud laminis longiores; *laminae* ovatae, acuminatae, latere utrinque infra medium late rotundato, supra repando 1-dentato, vel latissime brevissime 1-lobato, circiter 7 cm. longae, 5·5 cm. latae, partibus suprapetiolari et infrapetiolari ratione 4·5 : 1, obscure rubro-marmoratae, subtus dense tomentosae, epapillosae, supra tote glabri. *Pedicelli* glabri, gracillimi, a basi spiraliter cirrhosi, valde

petiolos superantes, usque 13 cm. longi. *Flores* glabri, 4·5–5 cm. longi; *calcar* rectum, conicum, apice attenuatum, 3·5 cm. longum, basi 7 mm. diametro; *sepala* obtusa, elliptico-oblonga; *petala* haud exserta, usque ad 6 mm. longa, superne dentato-ciliata, superiora late spathulato-oblonga, inferiora obtriangularia in unguem attenuata.

Colombia: without precise locality, *Lobb* 16.

21. **T. parvifolium,** *Hughes*, nov. sp. (Page 70, fig. B.).

Herba scandens. *Caulis* gracilis, subcurvatus, plus minusve compressus, ad nodos fulvo-tomentosus, caeterum glaber vel subpubescens. *Folia* estipulata; *petioli* graciles, basi vix incrassati, cirrhosi, usque ad 2 cm. longi, subpubescentes; *laminae* orbiculares vel plus minusve depressae, utrinque magis minusve 2-dentatae, peltatae, circiter 1 cm. longae, 1–1·4 cm. latae, partibus suprapetiolari et infrapetiolari ratione 4 : 1, fulvo-hirtellae, supra intense virides, subtus dense marmoratae (?), epapillosae. *Pedicelli* foliis conspicue longiores, usque 9 cm. longi, tenuiter filiformes, superne incrassati subcirrhosi, glabri. *Flores* 4·5–5 cm. longi, fulvo-hirtelli; *calcar* rectum, cylindricum, triangulari-ovatae, obtusa; *petala* non exserta, usque ad 6 mm. longa, spathulato-oblonga, breviter unguiculata, superne dentato-ciliata, dentibus 5.

Colombia: without precise locality, *Lobb* 18.

22. **T. fulvum,** *Buchenau & Sod.* in Engl. Jahrb. xxxiv Beibl. lxxviii, 11.

Herba alte scandens. *Caulis* obtusangulus, indistincte sulcatus, circiter 1·5 mm. diametro, breviter pubescens. *Folia* estipulata; *petioli* saepe curvati, raro cirrhosi, usque ad 3 cm. longi, laminis breviores, breviter pubescentes; *laminae* elongato-ovatae, basi rotundatae, apice acutae, marginibus indistincte crenulatis et supra medium unidentatis, strigosae, supra intense fulvo-virides, subtus pallidiores, epapillosae, partibus suprapetiolari et infrapetiolari ratione 5·2 usque 6 : 1, pilis longioribus (usque fere 2 mm. longis) fulvis obtectae. *Pedicelli* foliis conspicue (duplo vel triplo) longiores, filiformes, superne incrassati, saepe cirrhosi, pubescentes pilis brevibus apice longioribus. *Flores* 5 cm. longi, pilis fulvis ad 2 mm. longis induti; calcar elongato-conicum, fulvo-puniceum (?), supra 4·5, infra 4 cm. longum, basi diametro 7 usque 8 mm.; *sepala* fulvo-viridia (?), rectangula, rotundata, obtusa, circiter 5 mm. longa; *petala* non exserta, superne serrato-ciliata, probabiliter rubro-violacea. *Mericarpium* semiobiculare, lateribus rugosis, dorso rotundato, apice stilo coronato.

Ecuador: prope Tamboloma, crescit in silvis subtropicis ad viam Quito-Guayaquil, *Sodiro* 230; Rio Cristal, *André* 4009 (e descr.).

23. **T. pseudopubescens,** *Hughes,* nov. sp. (Page 84, fig. D.).

Herba alte scandens, ad 7·6 m. (ex Lehmann). *Caulis* gracilis, sparse pubescens. *Folia* estipulata; *petioli* subrobusti, subcirrhosi, usque ad 6 cm. longi, fulvo-hirti; *laminae* late rotundato-ovatae, magis minusve breviter lateque quinquelobae, rarius subintegrae, lobis subapicularis, 4 cm. longae lataeque vel paulo latiores, partibus suprapetiolari et infrapetiolari ratione 3·5 : 1, fulvo-hirtae, supra atrovirides, subtus rubro-punctatae infundo obscuro, epapillosae. *Pedicelli* gracillimi, cirrhosi, basi pubescentes, apicem versus glabri, petiolos superantes, circiter 13 cm. longi. *Flores* fulvo-hirti, 4–4·5 cm. longi; *calcar* rectum, conicum, apice luteo-viride, usque 3·5 cm. longum, basi 6 mm. diametro; *sepala* elliptica vel ovata, luteo-viridia; *petala* non exserta, superne dentato-ciliata, atra, 5–6 mm. longa, superiora obtriangularia in unguem attenuata, inferiora late spathulato-oblonga.

Colombia: Central Andes of Popayan, Paramo de Guauacas, 2800–3000 m., *Lehmann* 4709.

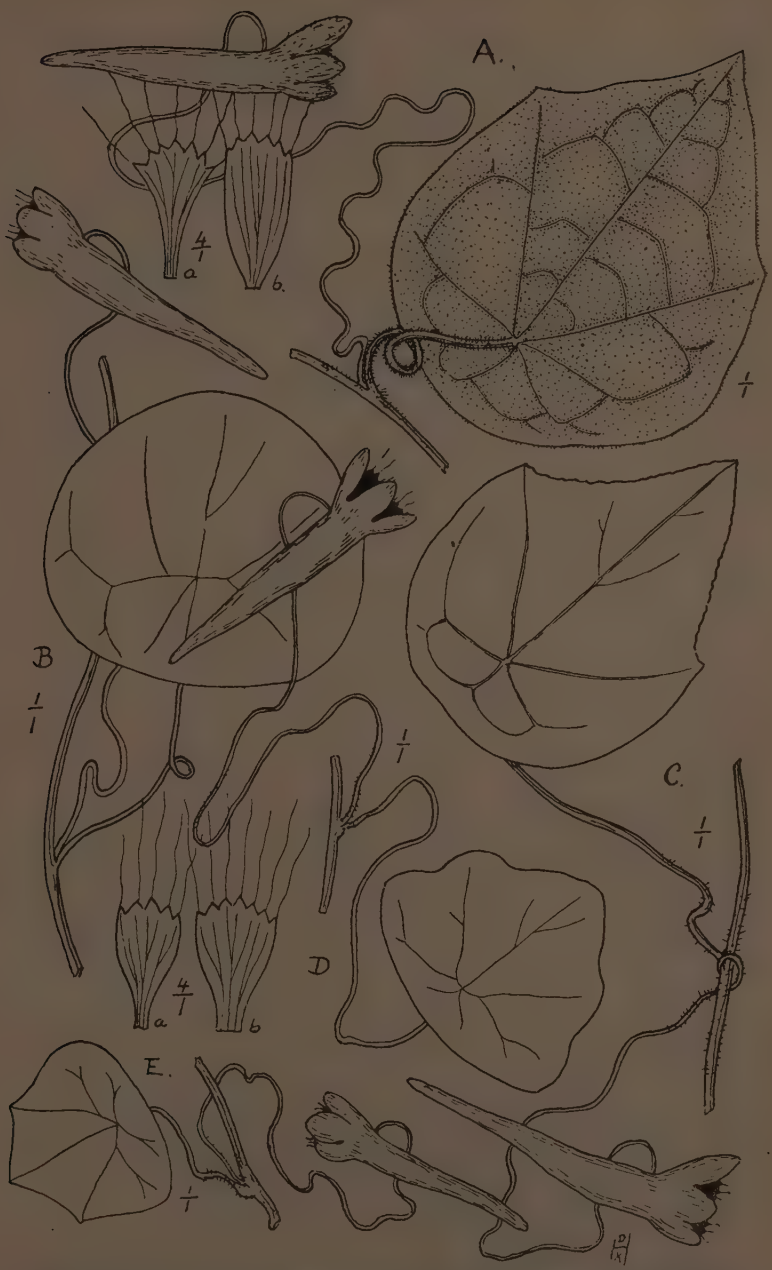
24. **T. adpressum,** *Hughes,* nov. sp. (Page 84, fig. C.)

Herba scandens. *Caulis* gracilis, pilis albidis imprimis ad nodos hirtus. *Folia* estipulata; *petioli* quam laminas breviores, usque ad 3 cm. longi, cirrhosi, hirti; *laminae* ovatae, acutae, 5 cm. longae, 4 cm. latae, supra medium trilobae, lobo terminali triangulari, lobis lateralibus acutis interdum obscuris, partibus suprapetiolari et infrapetiolari ratione 5 : 1, supra infraque pilis albidis adpressus maxime ad nodos indutae, subtus valde rubro-punctatae, epapillosae. *Pedicelli* gracillimi, subcirrhosi, petiolos valde superantes, circiter 7 cm. longi. *Flores* hirsuti, ad minimum sepala, 4·5–5 cm. longi; *calcar* rectum ultra medium cylindricum, denique conicum, 3·5 cm. longum, basi 5 mm. diametro; *sepala* ovata, viridia; *petala* haud exserta, superne dentato-ciliata, superiora lamina rotundato-ovata, in unguem attenuata, 6 mm. longa, inferiora minora, angustiora, 5 mm. longa.

Ecuador: Quito, *Jameson;* Western Andes, 1220 m., *Pearce* 397.

25. **T. coccineum,** *Hughes,* nov. sp. (Page 81, fig. C.)

Herba scandens. *Caulis* gracilis, pilis albidis apice obtusis imprimis ad nodos hirtus. *Folia* estipulata; *petioli* graciles vel robustiusculi, cirrhosi, glabrescentes, usque ad 5 cm. longi; *laminae* glabrae, ovatae, acutae, 5–6 cm. longi, 4 cm. latae, supra medium trilobae, lobo terminali triangulari, lobis lateralibus saepe multum reductis, plerumque obtusiusculis rarius nullis, margine interdum crispo-crenulato, partibus suprapetiolari et infrapetiolari ratione 3 : 1, supra subtusque rubro-marmoratae, epapillosae. *Pedicelli* gracillimi, cirrhosi, petiolos valde superantes, 14–16 cm. longi. *Flores* tote glabri, 5 cm. longi; *calcar* coccineum, rectum, conicum, 4 cm. longum, basi 5–7 mm. diametro; *sepala* ovata, obtusa, viridia; *petala* vix exserta,



A. *T. tomentosum.* B. *T. integrifolium.* C. *T. coccineum.* D. *T. maculifolium.* E. *T. kerneisinum.* a. petalum inferius. b. petalum superius. The petals of B. C. and D. are similar to those figured for E. differing only slightly in size (*see* descriptions).

7 mm. longa, superne dentato-ciliata, atro-caerulea, superiora late spathulato-oblonga, inferiora in unguem attenuata.

COLOMBIA: Prov. New Grenada, Quindio, *Purdie:* La Ceja, *André* 2204; *Lobb* 15.

26. **T. longifolium,** *Turcz.* in Bull. Soc. Nat. Moscow xxxi (1858) 423.

Herba scandens. *Caulis* teres vel leviter angulosus, glaber vel pilis fulvis ad 1·5 mm. longis, manifeste ad nodos, indutus. *Folia* stipulata; *stipulae* minutissimae, inconspicuae, deciduae; *petioli* subrobusti, cirrhosi, usque ad 6–8 cm. longi, glabri vel basi fulvo-pilosi; laminae ovato- vel oblongo-lanceolatae; obtuse acuminatae, basi rotundatae, integerrimae, usque ad 10 cm. longae et basi ad 3 cm. latae, partibus suprapetiolari et infrapetiolari ratione 4 : 1, intense virides, supra subtusque dense rubro-punctatae, glabrae, epapillosae. *Pedicelli* tenerrimae, cirrhosi, circiter 10 cm. longi, glabri. *Flores* glabri, 4–5 cm. longi; *calcar* rectum, conicum, apice leviter attenuatum, obtusum, 4 cm. longum, basi 5 mm. diametro, purpureo-rubrum; *sepala* ovata, apice rotundata, viridia; *petala* late spathulato-oblonga, basi leviter attenuata, superne 5-dentato-fimbriata, superiora 6 mm. longa, inferiora 9 mm. longa (fimbria excluda), atro-caerulea.

COLOMBIA: Antioquia, *Kalbreyer* 1548; New Grenada, Mariquita, *Triana* 3772.

27. **T. stipulatum,** *Buchenau & Sod.* in Engl. Jahrb. xxxiv Beibl. lxxviii, 12.

Herba alte scandens. *Caulis* erectus, saepe curvatus, plus minusve angulosus et sulcatus, usque fere 3 mm. diametro, pilis patentibus hirsutus. *Folia* egregie stipulata; *stipulae* frondosae, semiorbiculares, integrae vel indistincte crenulatae, usque 1 cm. diametro, glabrae; *petioli* saepe curvati, interdum breviter cirrhosi, 6 usque 12 cm. longi, pilis patentibus (praecipue prope nodos) obsiti; *laminae* peltatae, subreniformes, supra intense virides, subtus vix pallidiores, epapillosae, partibus suprapetiolari et infrapetiolari ratione 3·6 usque 4·3 : 1, vadissime quinquelobae, basi distincte repandae. *Pedicelli* gracillimi, cirrhosi, foliis breviores, sub flore incrassati, glabri. *Flores* 2·5 cm. longi, glabri; *calcar* conicum, puniceum (?), apice viride, supra 1·9, infra 1·8 cm. longum, basi usque 4·5 mm. diametro; *sepala* oblongo-rotundata, viridia, 4 usque 5 mm. longa; *petala* parva, non exserta, superne serrato-ciliata, nigro-violacea (?).

ECUADOR: Corazon, 2400–3000 m., *Sodiro* 224.

In the original diagnosis of this species the stipules are described as measuring 20 (rarely 30) mm. in diameter. I have examined the type specimen (*Sodiro* 224) and find that they do not exceed 1 cm. in diameter.

28. **T. maculifolium,** *Hughes*, nov. sp. (Page 81, fig. D.)

Herba scandens. *Caulis* gracilis, glaber vel subglabrescens. *Folia* estipulata; *petioli* gracilis, subcirrhosi, basi haud crassiores, usque ad 4 cm. longi; *laminae* glabrae, late rotundato-ovatae 3 cm. longi, 3·6 cm. latae, breviter lataeque quinque-lobae, lobis obtusissimis, margine obscure crenulato-crispo, partibus suprapetiolari et infrapetiolari ratione 3·5 : 1, supra subtusque dense rubro-marmoratae, epapillosae. *Pedicelli* subpubescentes, graciles, cirrhosi, petiolos superantes. *Flores* pubescentes, ad minimum sepala, 4·5 cm. longi; *calcar* rectum, conicum, usque 3·7 cm. longum, basi 6–7 mm. diametro; *sepala* elliptico-oblonga, obtusa, hirsuta pilis albis curvatisque; *petala* haud exserta, usque ad 6·5 mm. longa, superne dentato-ciliata, atro-caerulea, superiora late spathulato-oblonga, inferiora plus minusve in unguem attenuata.

Colombia: Andes of Bogota, *Saunders* 390.

29. **T. integrifolium,** *Hughes*, nov. sp. (Page 81, fig. B.).

Herba scandens, etuberosa (Hartweg), glabra. *Folia* estipulata; *petioli* graciles, vix cirrhosi, 4–6 cm. longi; *laminae* integrae vel subintegrae, suborbiculares vel rotundato-ovatae, 4–5 cm. longae, partibus suprapetiolari et infrapetiolari ratione 1·5–2 : 1, rubro-punctatae vel marmoratae, epapillosae. *Pedicelli* gracillimi, cirrhosi, valde petiolos superantes, usque ad 12 cm. longi. *Flores* 4·5 cm. longi; *calcar* rectum, anguste conicum, 3 cm. longum, basi usque 5 mm. diametro; *sepala* elliptica, obtusa, viridia; *petala* majuscula, usque ad 7·5 mm. longa, haud exserta, superne dentato-ciliata, superiora late obovato-cuneata, anguste unguiculata, inferiora minora, subunguiculata. *T. cirrhipes*, Benth., Pl. Hartw. 166. non Hook.

Colombia: Andes of Popayan, *Hartweg:* without precise locality, *Lobb* 6.

30. **T. kerneisinum,** *Hughes*, nov. sp. (Page 81, fig. E.)

Herba scandens. *Caulis* gracilis, subanfractuosus, internodiis 1·5–2 cm. longis, glabrescens. *Folia* stipulata; *stipulae* minutae, deciduae; *petioli* graciles, subcirrhosi, 2–3 cm. longi, glabri vel glabrescentes; *laminae* glabrae, suborbiculares, interdum plus minusve depressae, integrae vel superiores latissime sublobatae, lobis 3–5, 2·5–3 cm. longae lataeque vel paulo latiores, supra subtusque rubro-marmoratae, epapillosae. *Pedicelli* graciles, glabri, subcirrhosi, circiter 4·5 cm. longi. *Flores* glabri, usque ad 3 cm. longi; *calcar* coccineum, subcurvatum, angustum, a basi sensim attenuatum, apice obtusum, fere 2·5 cm. longum, basi 3 mm. diametro; *sepala* viridia, obtusa, ovato- vel elliptico-oblonga; *petala* non exserta, usque ad 5 mm. longa, superne dentato-ciliata, atroviolacea, superiora late elliptico-oblonga, vix vel brevissime unguiculata, inferiora cuneata, basi anguste attenuata.

A. *T. trilobum*. B. *T. pentagonum*. C. *T. adpressum*. D. *T. pseudo-pubescens*. all natural size. a. petalum inferius. b. petalum superius.

COLOMBIA: Andes of Pasto, Chimbalan woods, *André* 2951.

31. **T. pentagonum,** *Hughes*, nov. sp. (Page 84, fig. B.)

Herba scandens. *Caulis* gracilis, teres, ad nodos pubescens caeterum glabrescens. *Folia* stipulata; *stipulae* minutae, deciduae; *petioli* graciles, subcirrhosi, 2–2·5 cm. longi; *laminae* glabrae, pentagonae, basi late vetusae, quinquelobae, lobis obtusis interdum minute apiculatis, lobo infimo cum intermedio fere confluente, terminale late ovato, nervis primariis rectis, circiter 2·5 cm. longae lataeque vel paulo latiores, partibus suprapetiolari et infrapetiolari ratione 3 : 1, supra subtusque rubro-marmoratae, epapillosae. *Pedicelli* graciles, vix cirrhosi, subpubescentes, ad 6 cm. longi. *Flores* sparse pubescentes, 3 cm. longi; *calcar* rectum, anguste conicum, ad 2·3 cm. longum, basi 5 mm. diametro; *sepala* elliptico-ovata, obtusa; *petala* parva, haud exserta, spathulato-cuneata, superiora 5 mm. longa, inferiora 4 mm. longa, superne tenuissime dentato-ciliata.

COLOMBIA: Boqueron de Bogota, 2800 m., *André* 770.

32. **T. trilobum,** *Hughes*, nov. sp. (Page 84, fig. A.)

Herba scandens. *Caulis* gracilis, ad nodos pubescens, caeterum glaber. *Folia* estipulata; *petioli* glabri, graciles, subcirrhosi, 3–4 cm. longi; *laminae* glabrae, ambitu rotundato-ovatae, basi late convexae vel subtruncatae, trilobae, lobis latis obtusis, 3 cm. longae lataeque vel paulo latiores, partibus suprapetiolari et infrapetiolari ratione 6·5 : 1, marginis integris vel subcrenulatis, subtus rubro-marmoratae, epapillosae. *Pedicelli* graciles, subcirrhosi, vix petiolos superantes. *Flores* glabri, extra coccinei, 2·5–3 cm. longi; *calcar* rectum, conicum, 2 cm. longum, basi 6 mm. diametro; *sepala* elliptica, obtusa; *petala* haud exserta, atro-caerulea, 5 mm. longa, superne dentato-ciliata, dentibus 3, superiora late obovata in unguem angustum contracta, inferiora obovato-spathulata.

COLOMBIA: Afradita near Fusagasuga, 2000 m., *André* 1386.

X.—PHYTOPATHOLOGY IN THE UNITED STATES.

E. J. BUTLER.

With the permission of the Committee of the Imperial Bureau of Mycology the Report by Dr. E. J. Butler, Director of the Bureau, on his visit to America during July and August 1921 is here reprinted with a few omissions and alterations. We are glad to have been allowed to bring the Bureau of Mycology and its value to the Empire to the notice of a wider public through the medium of the *Bulletin*.

The immediate purpose of my visit to the United States was to attend a Conference on the diseases of cereals held by the American Phytopathological Society at St. Paul (Minnesota) and

Fargo (North Dakota) from July 19th to 23rd. The more important objects were, however, to visit a number of the chief centres of agricultural and botanical research in the eastern, southern and middle western States, and to meet as many of those engaged in research and the organization of research in these subjects as was possible in the time at my disposal. The specific aims that I had in view were : (1) to bring the international aspects of the work of the Imperial Bureau of Mycology before our American colleagues; (2) to enlist their co-operation in certain branches of this work, and to ascertain what assistance we might expect to obtain in the United States; (3) to examine the organization and present development of the study of plant pathology and its application to the prevention and control of crop diseases in the United States; and (4) to visit some of the chief crop areas of the eastern half of the country and see the conditions under which the crops are grown and the measures taken to improve varieties and methods. The time at my disposal was insufficient to carry out this last adequately.

The Conference on cereal diseases was attended by some fifty members of the American Phytopathological Society (including several Canadians), a few American visitors, and representatives from England, Japan, Australia, and the Philippines. It met at St. Paul from the 19th to the 21st of July, moved to Fargo on the night of the 21st, and terminated there at 10 p.m. on the 22nd. The daylight hours were mostly given to field meetings at the experimental farms at St. Paul and Fargo and automobile trips through the wheat belt of Minnesota and North Dakota, while meetings to discuss specific subjects were held in the evenings. The members were also taken through one of the largest elevators and flour mills in Minneapolis. The Conference concerned itself chiefly with the cereal rusts, particularly with the control of black rust by breeding resistant varieties, and the campaign for eradicating the barberry, on which this parasite spends part of its life; with the diseases caused by *Helminthosporium*, *Fusarium*, and *Sclerospora*; and with the newly introduced " take-all " and " flag-smut " of wheat. There is probably more work being done on these subjects than on any other branch of plant pathology in the United States at the present moment, and we had the benefit of having this work explained, and in some cases demonstrated, by those actually engaged in it. Educationally, the Conference was of considerable value.

Both before and after the Conference I visited a number of scientific institutions east of the Mississippi from Michigan to New Orleans, with a view to establishing direct relations with American mycologists and plant pathologists. Owing to the prominence given to the study of these subjects there are at present more men at work on them in the United States than in any other country. This work is being pursued not only in institutions specifically for applied science, such as the Bureau of Plant Industry at Washington and the State Experiment Stations,

but also in many of the Universities, such as (amongst those I visited) Cornell, Purdue, Illinois, St. Paul, and Wisconsin. The study of pure systematic mycology is, after a period of neglect, again showing marked evidence of vitality so that the lead taken by Germany in this branch will, I think, pass to America in the future. It seemed most important to enlist the interest of American workers in the Bureau of Mycology, and I found this the more easy in that the entomologists in several of the institutions visited were very familiar with the Imperial Bureau of Entomology in London and spoke highly of its value. At Wood's Hole, and the Cereal Conference, I met a number of members of the staff of institutions that I was unable to visit. Considerable interest was evinced in what was regarded as a new departure likely to be of value to workers in other countries. Most of the institutions visited are prepared to exchange their publications with those of the Bureau. In several cases I asked if I could count on the direct assistance of specialists in particular subjects, and in all these found the greatest readiness to co-operate. I am sure that our work will be supported and encouraged very generally in America, and that we can get an immense amount of help there. In Washington, in particular, I was promised invaluable assistance, everyone I approached, from Dr. Taylor, Chief of the Bureau of Plant Industry, downwards, being most cordial. The National Research Council and the Editorial Board of *Botanical Abstracts* were other bodies that undertook to give us any help they could, and the discussions I had with members of the latter Board were particularly useful in helping to determine the lines on which our new abstracting journal can be made most serviceable.

The trend of research work in America is towards specialization, as it is elsewhere, but American workers have been accused of carrying this to too great a length. This is, I think, to misunderstand the organization of research in that country. Though the individual is specialized, problems are approached from a wider angle than probably in any other country. One of the best illustrations of this can be got from the "project plan" of the organization of work in the Department of Agriculture. This is merely the co-operative investigation of a problem by a group of specialists under a project leader, each worker taking a particular aspect of the problem in which he is specially competent, but all keeping in touch with one another and with the project leader. The greatest care is taken, as a rule, to preserve the independence of the individual and to give the fullest play to original initiative and freedom of research. The inquiries are carried out at various centres, Federal and State officers co-operating in the work, and the former being posted, when necessary, to the State centres most suitable for the purpose. Half-a-dozen men may be working in several different States in close co-operation and under a common leader, but each carrying out a different side of the investigation, and with complete freedom of action.

The system was a result of the frank recognition of the fact that many, perhaps most, of the chief inquiries that needed to be taken up were beyond the capacity of any single individual to bring to a successful conclusion within a reasonable time, and that, for their solution, the separate aspects of each problem required very highly competent specialistic work, such as can only be acquired by deep or intensive study rather than by a broad survey. I believe this is the correct way to attack such problems, and that it is only in very rare cases that an investigator can be found whose knowledge of the several distinct aspects which the problem may present is deep enough to enable him to explore all or many of them adequately.

It is worthy of note that the National Research Council is working along somewhat similar lines. It is an organization established in 1916 by the National Academy of Sciences to advise and assist in applying the scientific and technical resources of the country to the objects of the War, and made permanent by an Executive Order of President Wilson's Government in 1918. It is not, however, in the usual sense a governmental institution. Its chief objects are to organize research, to stimulate research and its application, to formulate comprehensive projects of research and to promote co-operation " in order to secure concentration of effort, minimise duplication, and stimulate progress; but in all co-operative undertakings to give encouragement to individual initiative." It is controlled by its own members, who include representatives of the chief scientific and technical societies, government representatives, and members at large amongst whom, in 1920–21, were Mr. Elihu Root and Mr. Herbert Hoover, together with several leaders in industry, engineering, and the Press. It is supported by other than Government aid, but maintains close contact with Government departments in several of its divisions. In its attempts to bring together scattered work and workers, and to assist in co-ordinating scientific attack on large problems, it has largely adopted the " project plan," by the establishment of special committees of experts, which plan modes of attack and undertake to find men and means for carrying out the plan. There are about eighty such committees, and many of them have obtained appropriations from industrial and agricultural sources for specific research, *e.g.*, one from the Southern Pine Association of $10,000 for maintaining certain forestry researches, and one which is now being negotiated with a group of tobacco growers and manufacturers for the study of tobacco diseases. Through the Council, there is also being organized an Institute for Research in Tropical America which will have a very definite bearing on some aspects of the work of the Bureau of Mycology. I had the advantage of discussing these and other activities of the Council with Dr. L. R. Jones, Chairman, and Dr. McClung, past Chairman, of the Division of Biology and Agriculture, and Dr. Yerkes, Chairman of the

Research Information Service of the Council, who is Resident Director of the Service at the headquarters in Washington. The opportunity I had of examining the working of the latter service was of particular interest, since it is engaged on work very similar to the "informational" side of the work of the Bureau of Mycology.

The question of abstracting and indexing scientific literature is occupying the attention of various organizations in America. A joint committee of the National Research Council and the American Association for the Advancement of Science was formed to consider this matter in 1920, and the question of taking steps for the establishment of an international institute for scientific bibliographical work is being examined, Dr. Kellogg being now in Switzerland on behalf of the National Research Council with a view to reporting on the utilization of the Concilium Bibliographicum at Zurich as a nucleus for the proposed institute This is a matter of direct interest to the Bureau of Mycology.

In a general way, much more attention is being paid to the "business" side of the organization of scientific work in the United States than elsewhere, and this is coupled with the development of "team work" in attacking important problems. They are recent developments and have not yet begun to produce their full effects, but the thoroughness of the preliminary preparation and the numbers who have combined to give effect to these aims make it certain that the result will be a vast stimulation of research activities. It was several times remarked to me that the formation of the Bureaux of Entomology, Tropical Diseases, and Mycology in London was evidently in response to similar needs, and that we should keep in close touch with one another. In the development of closer international relations, the trend in America is in favour of separate national organizations in the different countries with close mutual relations rather than single international institutions such as the International Institute of Agriculture at Rome. In our work we cannot fail to develop international contacts, and the sympathetic attitude towards such contacts (especially with the British Empire) which I found to be pretty general in the States will be well worth consolidating. I found a very wide recognition of the truth that phytopathology is as definitely an international interest as public health, and in several addresses at functions which I attended the formation of the Bureau of Mycology was welcomed on account of the international significance of its work.

The chief places visited with the special object of seeing the work on crop improvement and diseases were St. Paul (Minnesota) for cereals, Fargo (North Dakota) for flax, Baton Rouge and Audubon Park (Louisiana) for sugarcane and rice, Hartsville (South Carolina) for cotton and maize, New Haven (Connecticut) for tobacco and maize, St. Catherines (Ontario, Canada) for fruit, Lansing (Michigan), Lafayette (Indiana), and Urbana (Illinois) for cereals, fruit, and vegetables, and Cornell (New York for maize.

The principal objects were to see what work was actually being done in certain areas on these crops, and to get into personal touch with the men in charge of this work so as to facilitate future relations. The chief value of this will be that I shall be better able to apply or to refer applications from overseas correspondents of the Bureau to the most likely American source of assistance in special inquiries. Want of time prevented me from fully carrying out my programme in this direction. What I saw convinced me that America is far ahead of other countries in the general application of modern methods of plant breeding and the use of fungicides for the reduction of the wastage due to disease. Maize, wheat, cotton, beans, sugarcane, tobacco, and fruit were the principal crops seen in which these methods were being applied with the greatest success.

The very great attention directed to this matter in the United States is the result not only of the magnitude of their agricultural industry, but also of the generally great severity of the diseases of their crops. On the whole, the diseases of plants that have an economic value are distinctly worse in the United States than in Europe, though not worse than in some of the overseas parts of the British Empire. The reason for this appears to be that there are two factors concerned in intensifying diseases in countries that are newly opened up to settled agriculture. (1) the crops grown are largely exotic, and hence become exposed to the attack of indigenous parasites against which they have not developed powers of resistance; (2) with the introduction of new plants of economic value, exotic parasites are brought in, and some of these develop into serious pests of pre-existing plants in their new home. In Europe both these factors doubtless operated in the past, and the latter was responsible for the enormous ravages of introduced vine diseases in the last century. But the process has been very gradual in Europe as compared with America, and the centuries-long history of the operation of these two factors in Europe has been condensed into the last century, or even half-century, in the United States, especially in the centre and west of the country. The same phenomenon is marked in many of the British overseas possessions, and is likely to become increasingly evident in some in the future.

It is impossible to exaggerate the value to a working mycologist of a tour in the United States at the present time. In the last ten years the study of the diseases of plants in that country has progressed until it now easily leads the rest of the world. Since the War, American phytopathologists have redoubled their energies, and the next ten years will, I believe, see an accelerated progress. The most noticeable feature at the moment is the concentration of numbers of workers on certain fundamental problems, such as the etiology of the mosaic group of diseases, biological specialization in parasitic fungi, and the factors determining resistance or susceptibility to disease. Innumerable new points of view and critical attacks on many existing concep-

tions regarding parasitism and plant diseases generally are encountered, and a new science of phytopathology is being built up on the basis of the intimate relationship between host-plant, parasite, and external conditions. It is essential for the progress of mycological science in this country that we should keep in close touch with current developments and trends of thought in the United States. Mere knowledge of the literature does not sufficiently satisfy this need, as the value of published work is often difficult to appraise at a distance and trends of thought are usually in advance of publication. The practice of sending British mycologists to the United States in response to the annual invitations that have been issued during the past few years by the American Phytopathological Society is a sound one, and its cost will be more than repaid in the increased efficiency of their work.

To the Bureau of Mycology there is a special advantage over the general one referred to above, in that both as a centre for distributing information and an organization for working out the parasitic fungus flora of the outlying parts of the Empire we will require all the assistance we can get from other workers. As a result of my visit, I feel that we can rely confidently on receiving a great deal of help from workers in the United States.

XI.—RECOVERY OF HEVEA TREES AFTER RINGING.

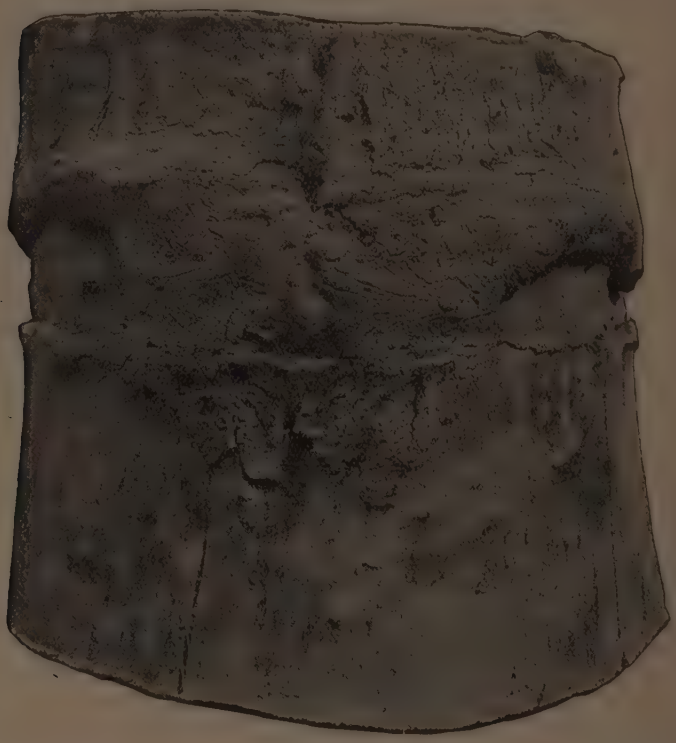
When at the Agege plantation, Nigeria, in the spring of last year (*see K. B.*, 1921, p. 234), I was interested to see the way in which the *Hevea* rubber trees had recovered from the ringing of the stems which had been done with the object of killing superfluous trees in order to thin out the plantations.

Mr. A. H. Kirby, late Asst. Director of Agriculture, Southern Provinces, Nigeria, in whose company I visited the plantation, has been good enough to send over two specimens of ringed trunks to Kew from one of which the photograph, here reproduced, has been taken. Unfortunately the trunks suffered a good deal of damage in transit, but they show remarkably well the bridging across of the ring, more than two inches broad, by the growing down of callous growth from the cortical tissues above the ring to meet and rejoin with the cortical tissues on the lower side of the ring. On account of the rate at which this growth was made, and certain other particulars in the behaviour of the ringed trees, it appears desirable that the results of this ringing experiment should be recorded, and Mr. Boodle has added some notes on the specimens.

A. W. H.

Mr. Kirby has kindly furnished the following particulars of the ringing of the trees and of their recovery :—" The Para rubber trees at Agege, that were tapped severely before their intended

removal in order to give room for the remainder, were ringed about a foot above ground in the dry season (December to February inclusive) of 1918–19, the cuts being two inches or so wide and care being taken that everything outside of the wood



was removed. After going on leave in May 1919, I returned in December of the same year and examined them in January 1920. By this time, many of the trees had been cut down to leave stumps eight to twelve feet in height; both these and those which had not been cut in any way since ringing were nearly all still alive and growing well, except where fires had been made against some of the stumps for the purpose of killing them because ringing had failed. In most cases these living stumps and trees had partly or completely grown a layer of wood and bark downward across the ring (*see* figure) in the form of a bridge, the breadth of the latter (horizontally) being usually from two to three inches, but six and seven inches respectively in the two specimens; there was generally only one such bridge, but sometimes two. The ringing had apparently had no effect on the top growth (branches and leaves) of the unlopped trees, whilst the 'stumps' had branched prolifically right at the top, there being, however, a tendency towards the formation of small,

weak branches lower down, in almost every case (where they appeared) at the upper part of the new layer across the ring.* I do not remember seeing any such lower, weak branches where this layer had not yet reached the under side of the ring. The leaves of the whippy, green branches formed by the stumps had the abnormally large leaflets that are characteristic of old or transplanted rubber seedlings. This apparently uninterrupted growth after ringing, and energetic renewal of growth after stumping and ringing, say much for the vitality of the Para rubber tree, especially when it is remembered that the trees under discussion had been tapped so severely that cuts for the tapping were made on the untouched half of the trunks before any bark renewal could take place on the half already tapped."

The effect of ringing on these trees, as described by Mr. Kirby, affords an example of rapid partial healing of wounds, involving the growth of callus and the formation of a layer of wood and bark over a vertical distance of two inches or more, within about twelve months from the time of ringing. In the two specimens sent to Kew, the cut appears to have been more than two inches across, the vertical growth made by the bridge being probably about $2\frac{1}{2}$ inches in the smaller stem, and nearly 3 inches in the larger. The specimens measure about 36 and 46 inches in circumference at the upper end, *i.e.*, at about a foot and a half above the soil. The trees were probably about twelve years old.

Petch† notes that "on young *Hevea*, wounds heal rapidly and completely," but adds that "experimental wounds, two and a half inches square, on twenty-three-year-old trees, have made very little progress towards a complete reconstruction of the bark in three years." The latter statement apparently implies a much slower growth of callus than that observed by Mr. Kirby, referable in part, perhaps, to a difference between the two lots of trees as to age and vigour, and possibly depending also on the difference in the nature of the wound.

In the case of some doubly ringed *Hevea* trees (said to be twelve years old, and badly grown), described by Petch,‡ it was found that, after fifteen months, complete or partial healing of one or both rings had taken place in nine out of sixteen trees. Each of the two rings was one inch wide.

These data do not include any record of such rapid growth of callus as that observed by Mr. Kirby.

The lack of appreciable damage to the top growth twelve months after ringing, as noted by Mr. Kirby, is not very surprising in a tree with a large amount of sap-wood like *Hevea*. The sap-wood was in fact found to extend right to the centre of the larger of the two specimens. Hence, although the wood exposed by ringing had, no doubt, become dead, dry and incapable of

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* Cf. Petch, The Physiology and Diseases of *Hevea brasiliensis*, 1911, p. 70.

† Petch, loc. cit., p. 71.

‡ Petch, loc. cit., p. 70.

conduction to some slight depth below the bare surface, one may assume that abundant conduction of water upwards through the ringed region would still be possible for a long time. The roots also would be able to carry on efficient absorption for a prolonged period, there being plentiful reserves of food-materials below the ring to provide for their growth.

As soon as a bridge has been formed across the ring, supplies from the crown can naturally pass down to the roots, and an approach to normal conditions for their nutrition is thus made.

XII.—MISCELLANEOUS NOTES.

Mr. L. Lewton Brain.—We learn that Mr. L. Lewton Brain, recently Director of Agriculture, Federated Malay States, has been appointed Technical Adviser in Agriculture to the Government of the Federated Malay States.

Mr. Geoffrey Corbett has been appointed by the Secretary of State for the Colonies, on the recommendation of Kew, Assistant Superintendent of Agriculture in the island of Rodriguez.

Retirement of Lieut.-Col. Sir David Prain.—The late Director retired on February 28th and has been succeeded by Dr. A. W. Hill, F.R.S., Assistant Director of the Royal Botanic Gardens since 1907. Sir David Prain was appointed Director in December 1905 (*see K.B.* 1905, p. 62).

On February 22nd, when the staff were kindly entertained at a farewell party by Sir David and Lady Prain, the occasion was taken advantage of to offer parting gifts to Sir David and Lady Prain and to hand to Sir David the following letter :—

To Lieut.-Colonel Sir David Prain, I.M.S., C.M.G., C.I.E., F.R.S.

We, the undersigned members of the Staff of the Royal Botanic Gardens, Kew, are desirous of taking the occasion of your retirement to express our cordial appreciation of the many and valuable services that you have rendered to Kew, to botanical and horticultural science, and to ourselves personally, during the sixteen years of your beneficent administration.

During a period marked by years of unparalleled difficulty you have been successful, by an unwearying devotion to the interests of the establishment, consummate tact and patience, in carrying on and even extending the innumerable activities with which Kew is identified, and in spite of the hampering influences of the war, great and lasting progress has been made. The splendid work of your predecessors has been consolidated and the reputation of Kew has been advanced from a high to a higher plane.

Your duties as Director of Kew, onerous as they are, have not constituted your only public service. Government have availed themselves freely of your knowledge and judgment by calling upon you to serve on many committees appointed to deal with post-war problems, particularly in the sphere of agricultural research.

You have been unsparing of yourself in the interests of science. You have served it as President of the Botanical Section of the British Association, involving a visit to Winnipeg, as President of the Linnean Society, and as Vice-President and Treasurer of the Royal Society of London.

These are but a few of the many offices to which you have been called, and your election to them has been a well-deserved tribute to your scholarship and your attainments as a Botanist, and has been an honour to Kew.

The welfare of your staff has ever been a matter of deepest concern to you and there is no member of that staff who has not experienced some amelioration in the conditions of service at Kew during your administration.

We earnestly hope that your life and health may be preserved for many years and that they may be happy years for you and Lady Prain.

We take leave of you with regret. We shall remember you with genuine affection and esteem.

(Signed)

Arthur W. Hill	Assistant Director.
J. Aikman	Assistant, Director's Office.
O. Stapf	Keeper of Herbarium and Library.
C. H. Wright	Assistant, Herbarium.
S. A. Skan	do. do.
T. A. Sprague	do. do.
Elsie M. Wakefield	do. do.
W. B. Turrill	do. do.
J. Hutchinson	do. do.
K. W. Braid	do. do.
S. T. Dunn	Assistant for India.
Arthur Kellett	Artist.
A. F. Fitch	Sub-Assistant, Herbarium.
M. G. Aikman	do. do.
D. K. Hughes	Temporary Technical Assistant.
Mabel I. Skan	do. do. do.
Ernest G. Dunk	do do. do.
D. R. Grey	do. do. do.
J. Masters Hillier	Keeper of Museums.
J. H. Holland	Assistant, Museums.
W. Dallimore	do. do.
L. A. Boodle	Assistant Keeper, Jodrell Laboratory.
W. Watson	Curator.
W. J. Bean	Assistant Curator.
W. N. Winn	Assistant, Curator's Office
W. Irving	Foreman.
C. P. Raffill	do.
Arthur Osborn	do.
W. Taylor	do.
J. Coutts	do.
G. Dear	Storekeeper.
Norah G. Watson	Sub-Assistant, Curator's Office.
W. Linney	Sergeant Constable.
L. Cottingham Burrell	Medical Officer.
G. D. Patterson	Clerk of Works.
J. E. Holman	Assistant do.
L. J. Harding	Museum Preparer.

Royal Botanic Gardens, Kew.
February 28, 1922.

Retirement of Dr. O. Stapf.—On February 28th Dr. O. Stapf, F.R.S., who has been Keeper of the Herbarium and Library since 1908, retired having reached the age limit. He is succeeded as Keeper by Mr. A. D. Cotton, F.L.S., formerly a member of the Herbarium staff and lately Mycologist to the Ministry of Agriculture and Fisheries.

Collection of Bark Beetles.—Dr. J. W. Munro, Entomologist of the Forestry Commission, has placed on loan in the Forestry Museum at Kew an almost complete set of workings of beetles which feed upon the inner bark and outer wood of trees in the British Isles. On the different sections of wood and bark the galleries peculiar to each beetle are well defined, and students are afforded a good opportunity for comparing the workings of allied insects. At the same time, the collection of bark beetles bequeathed to Kew, with other insects, by the late Mr. A. T. Gillanders has been rearranged and added to, so that Kew now possesses a very comprehensive collection of bark beetles and their workings. The collection includes the following species :—

Beetles.—*Scolytus destructor*, Oliv., and *S. multistriatus*, Marsh, on Elm; *S. intricatus*, Ratz., on Oak, *S. rugulosus*, Ratz., on Plum; *Hylesinus oleiperda*, Fabr., *H. crenatus*, Fabr., and *H. fraxini*, Fabr., on Ash, *H. vittatus*, Fabr., on Elm; *Myelophilus minor*, Hart., and *M. piniperda*, L. on Pine; *Phloeophthorus rhododactylus*, Marsh, on Broom; *Hylastes obscurus*, Marsh, on Broom; *Hylastes ater*, Payk., on Pine, *H.* spp. on roots of Pine; *Cissophagus hederae*, Schm., on Ivy; *Cryphalus abietis*, Ratz., on Fir, *C. tiliae*, Panz., on Lime, *C. fagi*, Fabr., on Beech, *C. binodulus*, Ratz., on Poplar; *Trypodendron lineatum*, Ol., on Spruce and Larch; *Pityogenes bidentatus*, Herbst., on Larch and Pine; *P. chalcographus*, L., on Spruce, *P. quadridens*, Hart., on Pine; *Pityophthorus* sp., on Pine; *Tomicus acuminatus*, Gyll., on Pine and Douglas Fir, *T. stenographus*, Duft., on Pine; and *T. typhographus*, L., on Spruce; *Dryocaetes villosus*, F., on Oak; *Xylocleptes bispinus*, Duft., on Clematis; *Xyleborus dispar*, F., on Holly; *Platypus cylindrus*, F., on Oak.

Weevils and Longhorns.—*Tetropium gabrieli*, Weise, on Larch; *Pissodes notatus*, F., and *P. pini*, L., on Pine; *Magdalis armigera*, Foure, on Elm; *Hylobius piceus*, Deg., on Spruce; *H. abietis*, Fabr., on Pine; *Rhagium bifasciatum*, F., on Pine.

W. D.

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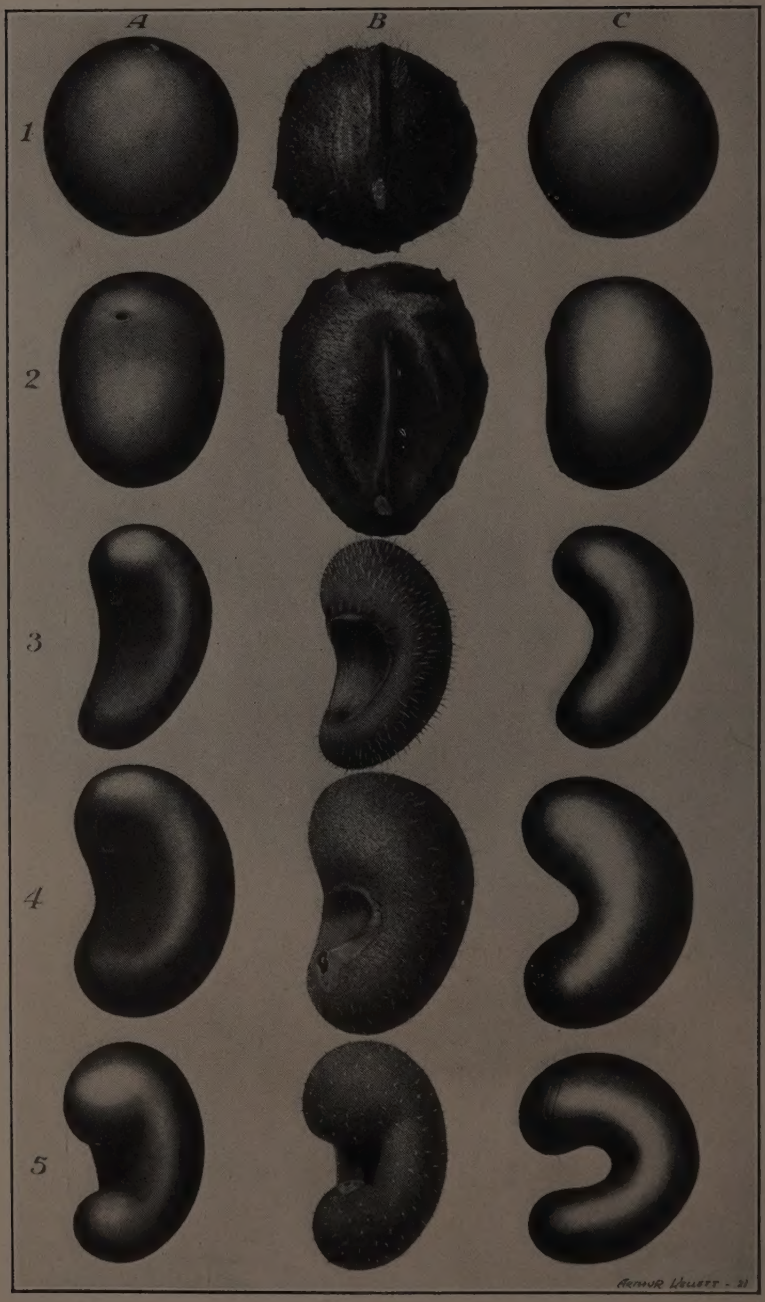

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